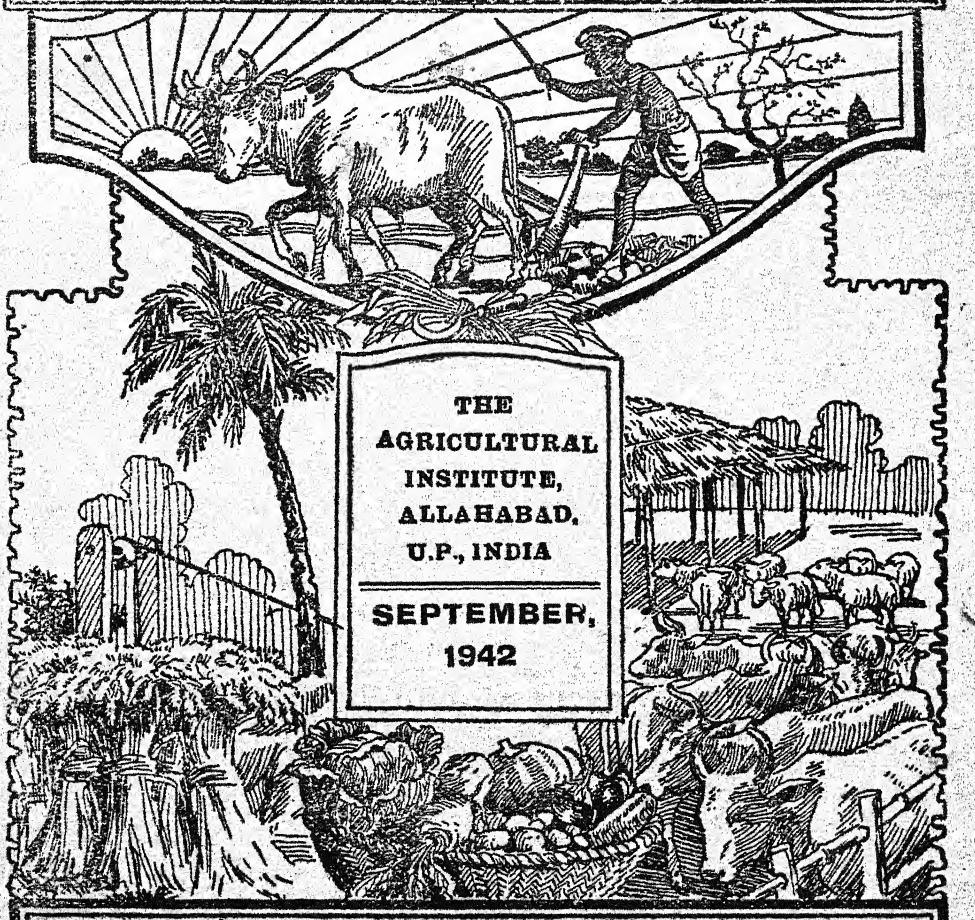
VOL. XVI] [No. 5

THE ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life



THE AGRICULTURAL INSTITUTE, ALLAHABAD, U.P., INDIA

SEPTEMBER, 1942

"As go the villages, so goes India."

KENYON A. BUTTERFIELD.

THE ALLAHABAD FARMER

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

The Allahabad Farmer is now approved by the Directors of Public Instruction in the United Provinces, Bengal, Central Provinces, Sind, Assam, Bihar, and Orissa, the Rural Reconstruction Commissioner, Punjab, and by the Director of the Institute of Plant Industry, Indore, and Agricultural Adviser to Rajputana and Central India States, for use in all schools under their jurisdiction.

Subscription Rates

Annual subscription : India, Rs. 3; England, 4 shillings; U.S.A., 1 dollar. Single copies, 10 annas; over five years old, 12 annas. Copies which are not received by subscribers will be supplied free of cost within six months of the month of issue. Thereafter single copy prices will be charged.

Unused portions of subscriptions cannot be refunded.

Advertising Rates

	Rs.	a.	p.
One full page of six numbers	35	0	0
One single full page	7	0	0
One half page of six numbers	20	0	0
One single half page	4	0	0
Page 2 or 3 of cover for six numbers ...	50	0	0
Page 4 of cover for six numbers	70	0	0

Contributions

The Allahabad Farmer is published in the first week of each alternate month commencing with the month of January. Contributors are requested to send in their articles at least one month prior to the next prospective date of publication.

Contributors will receive 15 reprints of the article published and additional copies at cost.

Publisher—The Allahabad Agricultural Institute, Allahabad, U.P. (American Presbyterian Mission).
Printer—The Mission Press, Allahabad, U. P.

Business correspondence should be addressed to the Business Manager, Allahabad Farmer.

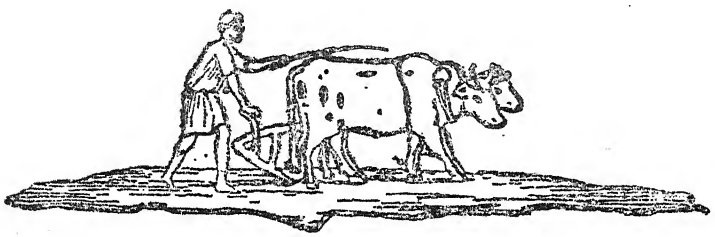
The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

Vol. XVI] SEPTEMBER, 1942 [No. 5

Table of Contents

THE
ALLAHABAD FARMER



VOL. XVI] SEPTEMBER, 1942 [No. 5

Editorials

The January, 1942 issue was a general report of the various departments of the Institute. Because of the response to that one, the Institute authorities think it wise to make one issue each year the Annual Report Number. This is it.

In spite of very difficult financial stringency, the worst agricultural season in years, and the tense political atmosphere, the Institute has gone steadily ahead. Owing to all building material being commandeered by the authorities, the new Campbell Memorial Hostel is not quite complete, but everything essential is there. The girls are living in it and very happy to have this very beautiful addition to their facilities.

The B. Sc. Ag. Engineering course is open with a full quota of students. We consider this one of the most important enterprises the Institute has ever undertaken. It is of superlative importance to India.

The Government has put on a "grow more food" campaign and God knows India needs more food. As far as it has gone, the monsoon is one of the best that I remember in the 38 years that I have observed the rains. My duty this year has caused me to travel a little. Never have I seen at this time of the year so much rice and fodder crops planted and so well grown and healthy looking. A good monsoon season not only means plenty of rice and fodder, but it is the very best preparation for the cold weather crops—wheat, barley, potatoes, linseed, gram, and vegetables of all kinds.

Because many commodities cannot now be imported, we wish we could produce more milk to turn into butter and cheese. We also wish we had more grapefruit and other fruits. Also there is great demand for good quality pork products. We desire facilities to start swine husbandry. This would cause employment for trained men, and food for those who care for it.

If there is anything that is not clear in the reports or any suggestions that our friends have to offer as how to improve them, we would be grateful if they would write to us. The Institute is glad to be able to serve India at this time of great need.—SAM HIGGINBOTTOM

Indian Dairy Diploma Examination Results:

Out of 22 who appeared this year in this examination, 15 passed and 7 failed. Those who passed are the following, arranged in the order of merit :—Sukumar De, Khazan Singh, Behere D. Datatray, Atar Singh, K. C. Banerjee, Kamakshyapada Chatterjee, Ravish C. Agarwal, Sushanta Dutt, Kanakendu Das Gupta, Aragula Sreenivasa Rao, Mallik Abdul Hashem, Shron Singh, Suchitra Kumar Nag, S. L. Som and A. W. Khan.

We congratulate the above on their success.

Potatoes are a source of vitamin C, providing one-sixth to one-fourth of a soldier's daily quota of this vitamin.—*Science News Letter.*

REPORT OF THE AGRONOMY DEPARTMENT 1941-42.

By

B. M. Pugh, S. R. Misra, & S. C. Bhatnagar.

Staff of the Department:—B. M. Pugh, B. Sc. (Calc.) B. Sc. Agri. (Calif, U. S. A.), B. D. (U. S. A.) Head of the Department.

G. Q. Vachoo, Marketing.

S. R. Misra, B.A., Dip. Agri., Farm Accounting.

E. J. W. Moraes, B. Sc. Ag. (Alld.), Assistant Instructor.

S. C. Bhatnagar, B. Sc. (Alld.), Assistant for field experimentation.

H. M. Browne, Time-keeper.

B. H. Pawar, Field assistant.

Mr. Moraes has to leave us at the end of the year in order to study Agricultural Engineering, and Mr. S. R. Barooah, M. Sc. has been added this year to assist in the teaching in the department. Mr. C. R. Horton of the Pyinmana Agricultural School in Burma worked temporarily in the department for a period of about one month and a half, and later had to leave us for America with his family. Mr. Bhatnagar has also joined the new Agricultural Engineering course, but is being continued part time in the department.

The activities of the department may be grouped under the following heads: (*a*) teaching, (*b*) demonstration, (*c*) research and experimentation.

Teaching:—B. M. Pugh and E. J. W. Moraes were the only full time teachers in the department. Mr. S. R. Misra also assisted in the teaching during the year.

Demonstration :—The report of the farm was first published in the last January issue of the Allahabad Farmer. This is now in the nature of an annual report of the farm for the last agricultural year, that is, June, 1941 to May, 1942.

The Weather :—It was an unfavourable year, resulting in reduced production of food, both for man and animals. The total rainfall in the year was below normal by 8" and its distribution was still more unsatisfactory. The monsoon started as early as the 3rd of June and light showers at irregular intervals continued till the middle of the month. The farm land was already ploughed during the summer and most of the *kharif* area was sown. Then followed a long break until the 3rd of July. The latter halves of July and August also had very deficient rainfall. Both the series of *kharif* crops sown in the first half of June as on the Institute farm, and in the first half of July as in the neighbouring villages, suffered a bad setback. Plenty of moisture, high humidity and intermittent sunshine are the most favourable conditions for the *kharif*, specially fodder, crops, resulting in their quick growth. This condition was seriously disturbed this year and led to the verge of a fodder famine in this area. The rainfall in June, July and August was hardly half of the normal in those months.

September rains are important, not so much for their direct effect on either *kharif* or *rabi* crops as for their indirect effect on them. The last and the heaviest rain of the monsoon fell on the 19th of September. It resulted in a good deal of soil erosion and in the cutting of *bunds*, terraces and flumes at places. The rain in this month was above normal and a great deal of it was unnecessary agriculturally.

However, the September rains did facilitate the seed bed preparation for the *rabi* and seemed to offer a good prospect for the *rabi* for a time. But later on, this hope was turned into despair, especially for the unirrigated area, as from the 20th of September through December it was entirely rainless.

The so-called 'Christmas' rains came much later, in the third week of January and were not only far more than necessary but were also attended by hail. The farm

luckily escaped the full blow of the hail, but the crops in some of the villages in the neighbourhood were ruined. The weather did not stop at this even; it completed its vagary by a 4·30 inch rain in the third week of February. In many fields water was knee-deep.

Irrigation:—The unsatisfactory conditions, as stated above, were aggravated by the unsatisfactory supply of irrigation water. The vagaries of the seasons and the defects of the municipal sewage irrigation system, both combined, gave an unprecedented below to the farm production this year. Sewage water was stopped for three long periods this year—August 12 to September 16, October 16 to 31, and February 21 to March 7. In addition to this, when water did run during the year, the supply was very poor. From September to March the average daily supply worked out at only 1½ lac gallons, when the minimum guaranteed daily supply was 2 lacs. The irrigated area is only one-fifth of the total cultivated area of the farm.

Crop yields :—As a result of these facts, crop yields, in many cases, have been reduced this year. The *rabi* crop yield was only 47 per cent of the last three years' average yield. Potatoes and other vegetables were about 70 per cent of the average. The yield of Fodder was saved from going so low as will be explained later. The loss may not show up in money income, as the prices were higher. But the average yields would have given much more income at the current prices, which was necessary to obtain, in order to meet the present higher wages and the costliness of other factors of production. While we tried to carry out the 'grow more food' campaign, nature seemed to go against it.

Land Improvement:—No new terracing project was undertaken this year, terraces cut by rain were repaired. Two *bunds* were widened into roads to facilitate bullock-cart haulage. Parts of two fields were levelled thus bringing about 6 acres into proper shape for cultivation.

Manure:—Manuring of fields with compost is the regular feature. But much more fresh manure was applied

this year directly to fields than ever before. A considerable quantity was trenched also. In addition 400 maunds of oil cake were bought, which are used mostly for vegetable crops. About 50 acres were green-manured with *sanai*.

Field Practices:—Eleven new pairs of oxen were purchased from Fatehpur Half of this number was to replace old ones. Greater use of bullock-drawn implements was in evidence. The movement of labour to war industries has led to a rather serious shortage of labour available for agriculture. This shortage of labour, already felt or impending, can be offset, to an appreciable extent, by the increased use of animal power in farming. The greater use of bullocks depends on the greater use of implements other than the *desi* plough.

This year's capricious monsoon bore out the effectiveness of dry weather ploughing more clearly than ever before. The moisture-absorbing and moisture-retaining capacity of the ploughed fields was demonstrated this year beyond all doubt. This was the factor primarily responsible for keeping up the yields of fodder this year almost to normal.

This was the first year in which about 50 acres of unirrigated juar were sown with seed drills in rows 30 inches apart. The crop was inter-cultivated and earthed up twice with bullock-cultivators. The crop was harvested in November and December for seed. The yield of juar seed worked out to about 10 maunds an acre and that of stover to about 200 maunds an acre. These yields are at least twice the normal. Undoubtedly a large share of this encouraging result is attributable to better spacing of plants and inter-cultivating which was made possible by their being sown in lines. *Arhar* was not sown in this area as a mixed crop, except on 10 acres, and there it proved to be a poor crop.

Research and Experimentation:—The most outstanding work of the department in this section is the publication of a report of "Farm Cost Accounts in the Allahabad Agricultural Institute," by Mr. S. R. Misra. The report was published in two instalments in the March and May issues of the Allahabad Farmer. Arrangements are being made to have the report published in one volume,

so that it can be made available to others who may not be subscribers to the Allahabad Farmer.

Another outstanding accomplishment during the course of the year was the work done by Mr. Horton. During his very short stay here in Allahabad Mr. Horton made a detailed soil survey and prepared a soil map with the assistance of Mr. Bhatnagar, of the unirrigated section of the farm, an area of about 300 acres. Most of this area will soon come under tube well irrigation. Mr. Horton has thus left us a valuable record of the methods used in soil surveys in the United States of America.

The Agronomy Department with the help of the students who specialized in Agronomy continued to carry on several field experiments Reports of some of these experiments have already been published from time to time in "The Allahabad Farmer." The report of the experiments on wheat appeared in the March issue of "The Farmer," and the report on other experiments are now being written and will be published soon.

The field experimentation of the Agronomy Department consists mostly of what are known as "bulk" trials, and "small growths" trials. And in order that the students may get acquainted with as many crops as possible, we have to deal with a very large number of crops, which makes the detailed study of any one crop an impossibility.

Rice:—In the year under report we had altogether 25 varieties, 14 of which were local selections and 11 were the varieties of the United Provinces Department of Agriculture, T. 23, T. 32, T. 471/11, C. H. 10, T. 12, T. 66, T. 21, T. 36, T. 136, T 1, Paddy No. 1, T. 6, and Paddy (early). Of the Government varieties T. 471/11, C. H. 10, T. 36, T. 136, T. 1, and T. 6 seemed to be promising. T. 136 and many of the local selections, however, were very badly infected by a disease known as Piricularia (so identified by Dr. Vestal). The promising varieties are being continued again this year.

Cotton:—In 1941-42 only four varieties were grown for bulk trial. These are Perso-American, C. 520, C. 402,

and Mollisoni 39. The trials were made for unirrigated conditions. As the weather this year was very unfavourable for cotton the yields were very poor and there was no significant difference between their yields. The experiment is being continued again this year.

Juar:—In the year under report we had a bulk trial of six varieties of this crop. The varieties were 8B, T.9, 5 Tall, Malwa Selection, Do-dana white and Do-dana yellow. The first three are varieties recommended by the United Provinces Department of Agriculture; Malwa Selection is a strain of Malwa juars brought by B. M. Pugh from Malwa, and the last two are local selections. Of these six, 8B gave this year the highest yield of grain followed by Malwa Selection, Do-dana white, then Do-dana yellow, T.9 and 5 Tall, all in the order of merit. However the yield data as well as other data, such as data of germination and the "stand" are being analysed statistically in order to find out the best variety for the year. These data with the data collected in previous years will be published in a separate paper on juar later. Mass selection was also made in these six varieties and the seeds are being used this year again for a bulk trial.

Arhar:—Four varieties of arhar were grown for bulk trial. The varieties were T.51, T.80, local and Rammonia. The last two are local selections. There was no significant difference in the yield of these varieties.

Bajra:—Three varieties were tried out this year. T.11 and T.16 (the Cawnpore varieties) and a local selection. Bajra did not have a fair trial this year, as the bajra plot was isolated, that is far from any other bajra plot, and therefore was subject to a very heavy attack of birds. The yield of grain showed no significant difference although the local seemed to yield more fodder than the other two.

Gram:—Three varieties of gram were grown for bulk trial, T. 17, T. 28 and a local variety. The data showed no significant difference in yield, although T. 17 possesses better grain and is more uniform in appearance. Both T. 17 and T. 28 are Imperial Pusa varieties.

Barley :—The following seven varieties of barley were grown in replicated randomized blocks:—H. 1-92, C. 251, T. 24, Local, T. 20, 300 A and I.P. 21. Of these C. 251 gave the highest yield of grain but was not significantly different from 300A or T. 20. These were followed by I. P. 21, Local, H. 1-92 and T. 24. This last was very poor. Of the varieties under trial the rust incidence of the Local variety was the worst. H. 1—29 and 300A were also very badly affected by rust. C. 251, T. 20, I. P. 21, and T. 24 showed some degree of resistance to some kinds of rust.

Linseed :—Four varieties of linseed were under trial. These were T. 1193, T. 1150, Nagpuri (A variety brought from Nagpur by Mr. K. K. Misra) and Local. There was no significant difference this year on the yield of seed. Of these four, Nagpuri is a bold type of linseed, the gramme count for Nagpuri being 105 to 108. The gramme counts for the other varieties were as follows: T. 1193, 120 to 125; T. 1150, 121 to 126; and Local, 118 to 123.

Wheat :—During the year under report eight varieties of wheat were grown for bulk trial. These were I.P. 165, I.P. 111, I P. 4, I.P. 54, I.P. 52, C. 13/A, C. 13/C, and Local. The planting was very much delayed so that the results may not be considered as reliable as in other years (*see the report on the wheat experiments in the March, 1942, issue of the Allahabad Farmer*). However, the data for yield, lodging and rust resistance were again recorded this year, and we report on these for what the reports are worth. A little explanation about C. 13/A and C. 13/C is perhaps necessary. C. 13 is a selection of Mr. Rama Prasada, Economic Botanist, U.P. Government. Mr. Bhatnagar, believing that there might have been deterioration in the C. 13 which we have at the Institute suggested that we get fresh seeds of C. 13 from Cawnpore. This was done. So the two lots of C. 13 were named C. 13/A and C. 13/C respectively. Results later seem to bear out the contention of Mr. Bhatnagar, but this will be tested again this next year.

The results of the grain yields in the bulk trial during the year under report were as follows:—C. 13/C—67·85,

I.P. 165—54·85, I.P. 54—50·85, I.P. 52—47·80, I.P. 111—42·90, C. 13/A—39·20, I.P. 4—38·55, and Local 22·00. In resistance to lodging the scores were I. P. 165—32, I. P. 111—28, I.P. 4—27, C. 13/A—21 I.P. 54—20, I. P. 52—19, C. 13/C—16, and Local—10. In rust resistance I P. 165 again came first followed by C. 13/C, C. 13/A, I.P. 111, I.P. 4 which appear to be in the same class and were followed by I.P. 54 and I.P. 52, which also seem to belong to a class by themselves, and these were followed by the Local which appears to be the worst. The yield of *bhusa* of the different varieties were C. 13/C—225, I.P. 54—177, I.P. 165—166, I.P. 52—157, C. 13/A—141, Local—122, I.P. 111—121, and I.P. 4—116.

Oats:—Six varieties of oats were under trial. These were C I. 2820, C.I. 2054, Local, Mulga, Westene and C.I. 3253. The C.I. varieties were from the "Crop investigations" department in U.S.A., Mulga and Westene are varieties from Indore. In fodder yields the records were as follows:—C.I. 2820—440, C.I. 2054—437, Local—422, Mulga—391, Westene—375 and C.I. 3253—313. The grain yields data were as follows: Local—123·40, C.I. 3253—122·95, Mulga—118·85, C.I. 2820—108·15, C.I. 2054—97·05, and Westene—84·50.

Small Growths Trials:—The department has also a plot in which varieties of crops received for the first time or which are not yet ready for bulk trials are grown for seed multiplication, or/and for preliminary observation, or/and for acclimatisation.

In this plot we had four types of *rai* (mustard):—R.T. 2, R.T. 3, R.T. 9, and one type of local *sarson* (also a mustard) and one type of *toria* (rape).

We also had six varieties of gram:—I.P. 53, I.P. 25, I.P. 58, T. 28, T. 12 and a local variety. Of these I.P. 53 seems to have done the best in these small growths trials.

Then we had three varieties of the Imperial Pusa (I.P.) oats, and eight American varieties. Of the first group, I.P. 2 seemed to be very promising. I.P. 1 also did well but the performance of I.P. Hybrid 1 was disappointing. Of the eight American varieties, Oats Selection 1297, Oats Victor Grain C.I. 3693, Oats Selection 1027, and C.I. 3730

have been selected for further trials. Others were discarded as they were too late to mature.

In the linseed there were nine varieties:—I.P. 55, I.P. 68, I P. 12, I.P. 14, I.P. 21, I.P. 10 and Local 1, Local 2, and Local 3. I.P. 68 appeared to be very promising, but all are being retained for further trial this year.

In the plot we also grew one I.P. 13 safflower, a fodder variety which is spineless, and also I.P. 29 pea. Then we started this year a zone trial of nine varieties of sugar cane which we received from Shahjahanpur. These are Cos. 146, Co. 313, Co. 527, Co. 393, Cos. 5, Cos. 76, Co. 331, Co. 421, Co. 312. Reports of the behaviour and performance of these canes will be made later.

We also started propagating three sugar-cane sorghum crosses which we received from R. Thomas, Esq., C I.E., of Mirpurkhas, Sind. The varieties are Co. 559, Co. 560, and Co. 561. These are at present doing well, but their values as fodder, for which they are intended, have not as yet been determined.

A Manurial Experiment:—The department was also carrying on this year an experiment with trenched manure. The experiment was started in 1939, and report of this experiment will be made later.

Plant Breeding:—Another type of work that was done in the *kharif* season this year was the survey of the *juar*, *bajra*, *mung* and *urd* crops of a locality about 16 square miles in area. As the result of this survey six new selections of *juar* were made, five of *bajra*, two of *mung* and two of *urd*.

In the *rabi* season a cross was made between I.P. 165 wheat and C. 13. Out of this cross 100 seeds were collected. Selections were also made on I.P. 4 for next year's progeny rows. In I.P. 54 certain plants were noticed to have red glumes. These were also collected for further study. We also made selections on the local wheats for next season's growth.

Selections were also made in oats, gram, and mustard. Seeds from a single plant of linseed which was characteristic of flax were also collected for further study.

REPORT OF THE HOME-MAKING DEPARTMENT, 1941-42

By

Dr. Ethel Cody Higginbottom

The new Campbell Memorial hostel is now occupied by 15 girls. It was not ready for use on July 6th because building material had been commandeered for military work. Also carpenters were difficult to get so we do not yet have all the furniture which we need. Even so our new building with its big airy living rooms is a great pleasure to us all. Lady Hallett who laid the corner-stone of this new hostel was happy at a recent visit to see the nearly completed building occupied by the girls. Both she and H. E. The Governor remarked on the fine structure and attractiveness as well as the utility of the building as a whole. Mr. Campbell and his children recently added to their original gift a sum which cares for the extra building cost and lets us furnish the building more comfortably.

Because of the difficulty in getting back and forth to classes in the engineering building and because Science building class-rooms are in greater demand this year, the living rooms of the west practice house are in use as class-rooms. This means that only one practice house is used as such. First year girls live in the second practice house but the kitchen is used for the foods laboratory, the living room is a class room and one bed room is the handicrafts room. This means all our equipment is at hand and ready to be moved into a class-room building when we get it. We hope that it will come soon so that we can fill the west house with girls next year.

We had between 30 to 40 applications from girls who wanted to enter but as we had only four small Government stipends to offer, and there are other E. T. C. training schools which could offer bigger and more stipends, some of the girls who had to have help have gone to these other institutions. However gifts from friends have made it

possible to help a few girls from needy homes. Our first year class now consists of 14 splendid young women. All the seven girls of the 2nd year class have also returned and are hard at work in their E. T. C. preparation. There are two special students and more may come.

Mrs. Azariah having acquired a little son has not yet returned but we hope to have a nursery school when she is back with us. Mrs. Warner who now has a healthy little daughter of 7 months has begun work again teaching nutrition. Mrs. Vaugh is undertaking to help with our handicrafts since, we are sorry to say, Mrs. Pugh has been ill. Mrs. Pugh is making slow progress and we hope later on will be able to teach. Meanwhile Mrs. Koshy, one of our own graduates and wife of a staff member and warden, has returned from her home in Travancore with her 3 months' old baby and is doing her share in teaching handicrafts. Of course without Miss Hoffman we could not carry on as she teaches chemistry of foods, cooking, sewing, meal planning, the supervision and care of the hostel and the home practice unit; besides Miss Hoffman and Mrs. Joshi care for the sports. All the men on the staff are helpful but Mr. Vaugh with the building, Mr. Hayes with the admissions and other work, Mr. Wesley teaching Nature Study and General Science and Mr. Chand teaching gardening and planning our flower gardens make it possible to keep our department going. All the staff members have been splendid in helping with the chaperoning. Miss Ellen Singh is again hard at work inspiring girls to take seriously class room management, and practice teaching. She is eating at the teachers' table in the new dining room with Miss Hoffman, Miss Das the matron, and Miss Hilda Singh, a former student, now an assistant staff member. Dr. Hayes not only teaches hygiene but has examined all the girls and cared for the sick. Unfortunately one girl came with fever which proved to be typhoid. Her mother came to help in her care and will soon be able to take her daughter home. Most of us staff members need Dr. Hayes in order to keep fit for our job.

Various parties given by students and staff members cheer the young people during week-ends. Church across

(*Continued on page* 338.)

REPORT OF THE DEPARTMENT OF AGRICULTURAL ENGINEERING, 1941-42.

By

Mason Vaugh

The outstanding event of interest along agricultural engineering lines during this year has been the completion of arrangements for the institution of the degree course in agricultural engineering at the Institute, in co-operation with the Allahabad University. As is the case in the courses in other branches of agriculture, leading to the B. Sc. (Agr.) degree, students with the minimum qualifications of Intermediate diploma in agriculture, are admitted by the University on the recommendation of the Institute. All teaching is done at the Institute and the final examination is set by and the degree awarded to successful candidates by the University. The tentative arrangements, reported last year, were completed late in the academic year and as this report goes to Press students are actually in attendance.

This event is of some historic importance because it marks the first time that training of a professional nature in the application of engineering to agriculture has been offered in Southern Asia. The Industrial Revolution in Western countries began to make modern materials and mechanical power available for the use of agriculturists late in the 18th century. The fourth decade of the 19th century saw the beginning of the revolution in western agriculture in the perfecting and marketing of the reaper for harvesting grain crops. Early inventions of new implements was carried out by farmers, local blacksmiths and other "laymen". Their development and manufacture was carried on by men trained in agriculture and in the older branches of engineering. It was not till the beginning of the second decade of the 20th century, about 30 years ago, that the training on a professional basis of men in the application of engineering knowledge to agriculture was begun. Such training has been

widely developed in the United States and Canada, where some 30 colleges now give such professional training. England has so far developed it only in one school where graduate training is available. India is thus still among the pioneers in this development.

At the time of writing, registration of students is not complete but it is expected that the full class of 12 men will be admitted. The number of applications has been more than that of the seats available, indicating a widespread interest in the subject. Non-professional training in some agricultural engineering subjects has been included for a long time in the curriculum of the agricultural colleges in India which has served to some extent to acquaint people with the possibilities of the development of Indian agriculture by the sound application of engineering principles along with the other branches of knowledge.

Most of the changes in staff occurring in the year were reported in the previous report which covered part of the year now under report. Having a fully trained agricultural engineer, Mr. M. D. Strong, on the staff has greatly strengthened the teaching work. The transfer of Mr. M. K. Nandy to the duties of Mr. J. C. Barpujari on his resignation to accept a job in the Assam Department of Agriculture, left no one to carry on the work for which Mr. Nandy had been appointed. At the end of March, Mr. Thoomickian left the post of salesman to seek other work. Mr. P. K. Bhargava, B. Sc. (Agr. 1942) was appointed salesman from May 1st. Due to delay in appointing new staff for the engineering course, it has been necessary to use Mr. Bhargava temporarily for teaching work but it is expected that he will revert to his regular post about the time this appears in print. Mr. Nandy has been given leave to take the degree in agricultural engineering and is for the next two years to be a student. He will give part-time assistance in the work of the department during this time.

Research and development work has rather lagged during the year under report, partly because of lack of staff capable of doing the work, partly because of the generally unsettled conditions due to the war and partly due to

a pause to digest previous progress. It is being increasingly recognised that the development of new implements alone is not sufficient. Equally or possibly more important is the development of suitable procedures and techniques to go with them. New implements make possible operations not previously possible. The effectiveness of the new implements and consequently their ultimate popularity depends on the exploitation of these new techniques in the operations made possible by the improvement in the implements. Considerable time has been devoted to a study of the procedures to be followed in various field operations and some field tests have been initiated. It is felt that it is important that we develope implements and technique simultaneously, modifying each in the light of the other. Indian climatic conditions differ radically from those of the western agricultural countries, where the use of improved implements is most widespread. This difference is reflected in soil conditions, in desired operations and in crops grown. It seems definitely certain that we will not get best results by the adoption of techniques and procedures developed in the western countries any more than we would by the wholesale adoption of western implements. This study has occupied most of the time available for research and development. Some time has continued to be given to problems previously mentioned as being under development.

The manufacture and sale of implements has continued about as before during this year. Full development of sales was hampered by the uncertainty as to whether material would be available for manufacture or not. This uncertainty led to caution about pushing sales. Material purchased was subject to great delay in arriving and especially toward the end of the year, considerable and increasing delay occurred in booking implements being despatched. In view of this uncertainty, sales for the year were highly satisfactory. The following table shows the number of implements sold and the prices realised.

			Rs.	a.	p.
Shabash ploughs	...	1,131	6,338	12	0
Shabash cultivators	..	11	146	0	0
Wah Wah Plough sets	...	51	1,431	10	0
U. P. ploughs	...	12	342	4	0

		Rs.	a.	p.
Wah Wah seeding machine	1	125	0	0
Butter churns ...	2	150	0	0
Butter workers ..	1	45	0	0
Spare shares ...	400	353	2	3
Hand hoes and rakes ...	25	20	10	0
Earth scoops ...	3	135	0	0
Loppers and hedge shears ...	6	27	8	0
Latrine borers ...	17	840	0	0
Butter paddles, etc. pc. ...	16	12	0	0
	Total	9,977	7	3

The above list of sales include only items sold to those outside the Institute. It does not include any items used in our own work or our manufacture. Some orders had to be refused due to lack of material at the time of the order. The resignation of Mr. Thoomickian as salesman reduced the amount of touring which could be done and doubtless reduced sales somewhat. Conditions of railway travel is likely to hamper touring of the salesman this next year also.

The work of maintenance of our plant and the erection of new buildings has continued about as usual. During the latter part of the year, the new building for the Home-Making Department was under construction and before this is in print the building will be fully occupied though some items such as the parapet around the roof and the upstairs verandah railings have had to be left undone because of lack of material. Early in the year, a new transformer was installed in our power sub-station, bringing into effect a new contract with the Electric Supply Co. by which we get more favourable rates than before. The wiring of the sub station was redone and the switch-boards were re arranged. The power line has been extended to the new tube-well and at the time of writing, the work of construction and installation is going on at the tube-well, preparatory to bringing it into use for the next cold weather crop.

While the war is causing increasing difficulty in getting supplies and our old stocks are slowly being depleted, we have been fortunate in that we have been able to get all essential commodities up to our minimum necessities. There is now doubt whether we can maintain this fortunate position in the future but we are thankful that it has been possible up to now.

REPORT OF THE DEPARTMENT OF HORTICULTURE, 1941-42

By

W. B. Hayes

The disease which had appeared on certain citrus trees a few weeks before the last report was written soon ceased to spread, and in the early spring new growth appeared on the infected branches. Later the dead twigs were removed, and there has been no further evidence of the disease, the cause of which remained unknown. At present the trees appear normal, but a watch will be kept for symptoms during the coming winter.

The summer was unusually hard on trees, and a number of grapefruit trees which had been weakened by gummosis died, as well as a few young trees which had not become well established. The seedling grapefruit trees have now been planted in the orchard for 10 years, and although they are planted 25 feet apart and are tall, some of them are beginning to touch each other. Many of them are bearing a satisfactory crop, but some have not yet borne.

Records of the estimated number and weight of guavas from heavily and lightly pruned trees in the last season are similar to those in previous years. The fruits on the heavily pruned trees were nearly twice the size of those on the lightly pruned trees, but there were so few of them that lightly pruned trees planted 25 feet apart produced about twice as much fruit per acre as the heavily pruned trees at 15 feet. A few lightly pruned trees at 15 feet produced about 7% more per acre than those at 25 feet, but they are crowded so that cultivation by animals is impossible, and the yield cannot be expected to increase, while the trees which are 25 feet apart should continue to grow and to produce increasingly heavy crops for several years. Thinning was practised on six of the trees planted 25 feet apart, selected at random. From one-third to two-thirds of the fruits were removed

while quite small. It happened that even with this thinning, more fruits remained on the trees than the average for the block. The size of the fruits was increased about 50% over the unthinned trees.

No conclusive results were obtained by spraying sweet orange trees with salts of zinc or iron. Considerable mottle-leaf is still evident, and experiments are being continued.

Experimental work on fruit products has been continued. After trying several recipes, squash was successfully prepared from the Rangpur lime, hill lemon and *athani*. Lime and lemon cordial with an attractive colour was also made. A recipe for guava cheese which seems satisfactory has been worked out, and cheese made by it was kept in good condition for eight months in an ordinary glass jar. Further improvement has been made in mango squash, and this has proved very successful as a flavouring for ice cream made by the Institute Dairy. It imparts a pleasing colour as well as a delicious flavour to the product. Mango pulp and peas have been successfully canned.

During the summer vacation I visited a place in the Kumaun hills, not far from the Nepal border, where I had heard there were wild lemons. There proved to be two types. One, called *jamir*, seems to be the rough lemon, or something very similar. The other, which was called *agnia*, was different from anything I had previously seen or heard of. The fruit is flattened globular, said to be yellow when ripe, and very sour. A typical leaf was about nine inches long, and more than half of it was the winged petiole. Small plants of both types were brought to Allahabad.

A factory in Brazil will turn oranges into concentrated juice, cattle fodder, and paper pulp.—*Science News Letter.*

German chemists have evolved a rice-like new food, mainly made of potatoes and whey.—*Science News Letter.*

REPORT OF THE DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRYING, 1941-42.

By

James N. Warner

This report covers the period corresponding to the financial year of the Institute, that is April, 1941 to March, 1942, inclusive. The first report of this series, published in January of this year, was an attempt to set forth an approximation of the scale and scope of the activities of this Department. It is not intended that all reports shall follow the form already established, but the form of tables will be changed as little as possible from time to time to avoid the confusion that arises whenever it is necessary for the reader to transcribe data in one form to data in another in order to compare the same tables in different reports.

Table I

Sales of Milk and Milk Products from April, 1941 *to March,* 1942

(Figures in Pounds and Ounces)

	Milk	Butter	Dahi	Cream Cheese	Cream	Ghi	Ice Cream	Cheddar Cheese	Daily average for milk
April ..	26,131-8	1,401-6	1,988-8	75-12	33-2	5-7	308-8	..	871-8
May .	20,720-8	1,057-4	885-0	26-13	12-2	..	242-0	..	668-6
June ..	18,361-0	1,125-13	609-0	65-4	8-12	10-0	125-8	..	612-5
July ..	23,895-0	1,548-7	996-0	40-0	21-4	..	42-0	..	770-13
August ..	30,467-0	1,584-0	1,425-0	11-14	18-0	..	167-0	..	982-13
September	29,008-8	1,463-11	1,290-0	25-0	18-10	..	114-0	..	966-15
October ..	30,806-8	1,725-0	1,288-8	59-0	19-4	..	104-0	..	933-11
November	27,153-0	1,959-7	963-8	93-12	27-4	..	166-0	..	905-1
December	21,037-0	2,300-10	834-0	101-6	41-10	1-8	..	..	678-9
January ..	17,017-8	2,914-15	730-0	84-4	29-6	40-7	..	13-8	548-15
February	16,503-0	1,908-1	864-8	75-4	39-11	25-10	55-0	19-14	589-5
March ..	19,370-8	2,083-9	2,093-8	83-12	39-0	3-14	416-8	147-2	625-0
Total ..	280,471-0	21,072-3	13,967-8	742-1	308-1	86-14	1,740-8	180-8	768-6

Milk and Milk Products :—The sales of milk and milk products during the year are given in Table I. Sales by months are indicated to show the variations from month to month for each product.

Daily milk sales were highest in October and lowest in January. The difference in the daily averages of the two months was 444 pounds 12 ounces or approximately 82% of the January sales. Normally the lowest sales occur in May and June. This year, however, the increase in the retail price of milk was largely the cause of a decrease of monthly sales of 4000 pounds during that month as compared with December. Furthermore, the demand for fluid milk in Allahabad during the hct months, when schools are closed and large numbers of people are on holiday elsewhere, was unusually high this year as a result of many semi-permanent visitors in the city. The total of 280,471 pounds sold during the year is the highest yet for this Department.

Butter sales varied from 1057 pounds in May to 2915 pounds in January. The minimum demand for butter normally occurs in May, or possibly June. This demand usually increases rather rapidly until the month of September or October. This condition, although common, has not manifest itself in sales increases for several years, especially this one

Village cattle and buffaloes are allowed to breed at will. This results in a majority of these animals freshening within a period of two months or so. It is, therefore, immediately after a calving season that villages supply the maximum amounts of milk or cream. This season of high supply, unfortunately, does not correspond with the highest demand for butter.

As the butter demand increases after July it has been found impossible to obtain the necessary cream. The figures for butter sales, although they show an increase from June through August, indicate not the total demand for butter which could have been met, but rather that portion of an increasing demand which it was found possible to meet under the conditions indicated. A cream supply that would rise and fall with the butter demand is obviously the ideal.

Supervised control of the calving season in our surrounding villages, it appears, is indicated.

Dahi is a hot weather product, that is its demand varies with the seasons, as indicated by the sudden rise in sales from 864 pounds in February to 2093 pounds in March. Sales of dahi are low in May, June and July also because of the movement of many of the customers of our dairy from Allahabad to their homes, in the case of students, or to holiday resorts. Dahi sales varied from 609 pounds in June to 2093 pounds in March, a variation of nearly 345% of the minimum.

Very small quantities of cream cheese and cream are sold. These are products for which there is very little demand in the home, especially in the case of cream cheese. The small quantities of cream that are used are more commonly obtained by partly skimming milk which is available than by direct purchase.

Ghi must sell at very high prices before it is economical under commercial conditions. Occasional small quantities are made by students of the Institute in their dairy practical work. There are also times when a small accumulated stock of butter may be converted into ghi in order to dispose of it. Otherwise ghi is not made by this Department.

The average ice cream order was for 18 3 pounds. During the year over 1700 pounds were sold, principally in the months of March, April and May. Ice cream, as has been stated in reference to dahi, is another seasonal product. Sales during two and one-half months in the winter were nil, whereas 416 pounds 8 ounces were sold in March alone. June and July sales were small principally because of the absence of customers, especially in June. Sales in October and November held up to those during the hot months of the monsoon because this product sold in fair quantities daily at the All India Swadeshi Exhibition where the Department maintained a stall.

Four flavours have been offered, *viz.* vanilla, chocolate, mango and gur-nut. Mango is made by the use of a mango squash prepared in the Horticulture Department and which has proved to be a very fine quality product

for the purpose The quality of the gur alone has limited the sales of the gur-nut. Vanilla sales, as is true in most countries of the world, surpasses any other.

Cheddar type cheese of a fair quality can be made domestically if two fundamental conditions are met: the supply of milk must be of an unusual high quality and refrigeration must be available for curing. This Department has no difficulty producing its own milk of the quality required for good cheese. It was, however, only after a small refrigeration plant was reconditioned for operating a cold room, constructed three years ago, at the required temperatures, that we could attempt to produce small amounts of cheese commercially. Again students have always made some for practice, but without proper curing facilities it was not extended beyond the purpose it served students.

About 180 pounds of this cheese were sold in the last three months of this year. This is, however, only the beginning of a programme of converting most surplus milk, during the season of low milk sales, into cheese. In this case also the figures represent the quantity it was possible to make, not the total demand, as it was too great to meet under the circumstances, despite the fact that the manufacture of this product has just started. Much greater sales during the next year are certain.

All India Students' Cattle Judging Contest

The second All India Students' Cattle Judging Contest was held at the Fifth All India Cattle Show at Delhi in February. Seven teams competed this year as compared to nine the year before. The first prize this year was won by the team representing this Institute Students comprising the team were 1. Mr. A. S. Verma (Captain), 2. Mr. K. Khazan Singh, 3. Mr. Shron Singh, 4. Mr. K. Das Gupta and 5. Mr. S. K. Nag.

Scoring this year was based on the placing of the animals, oral reasons and written reasons for the placing. The team tied for second in placing the animals, tied for third in oral reasons for the placing and was second in written reasons.

Milking Stock

The strength of the Institute milking herd during the financial year of 1941-42, ending on 31st March, 1942, was as follows :—

TABLE II

	Number on 1-4-'41	Transferred from female young stock	Sold	Died	Number on 31-3-'42
Red Sindhi	35	5	3	1	36
Jersey-Sindhi ..	24	2	1	..	25
Brownswiss-Sindhi / Brownswiss-Harriana ..	8	..	..	..	8
¼ Jersey-Sindhi ..	9	8	1	..	16
¼ Brownswiss-Sindhi / ¼ Brownswiss-Harriana	14	5	1	..	18
¼ Holstein-Sindhi ..	7	..	1	..	6
1/8 Jersey-Sindhi ..	..	2	..	..	2
1/8 Brownswiss-Sindhi ..	..	1	..	..	1
1/8 Holstein-Sindhi .	..	1	..	..	1
Miscellaneous cows .	24	5	4	4	21
Murrah buffalo ..	28	12	1	2	37
Totals ..	149	41	12	7	171

Our breeding policy has remained the same as was outlined in last year's report.

During the annual Farmers' Fair a good number of grade Murrah buffaloes was entered by the villagers. It was encouraging also to see a large number of entries of cows as compared to the previous year. The village gowallas' milking competition and village gowallas' judging contest attracted

considerable attention of the villagers. One noteworthy feature was that in both of these competitions younger men excelled their elders.

The following statement shows the performance of those animals which completed their lactations during the year.

TABLE III

	No. of Lactations completed during the year 1941-'42.	Average yield in lbs.	Average days in milk.	Average days dry preceding the lactation.	Milking average per day during milking period.	Over all average.
					lbs.	lbs.
Red Sindhi ..	23	3463·3	308·4	101·3	11·2	8·4
Jersey-Sindhi ..	20	4388·0	320·4	67·4	13·7	11·3
Brownswiss-Sindhi / Brownswiss-Hariana.	7	5072·0	377·5	72 1	13·4	11·2
¼ Holstein-Sindhi	7	4557·3	284 0	93 0	16·0	12·0
¼ Brownswiss-Sindhi	13	4242·5	324·6	85·2	13·0	10·3
½ Jersey-Sindhi ..	8	4237·8	323 2	81·7	13·1	10·4
Miscellaneous cows	18	3703·2	318·2	115 0	11 6	8·5
Murrah buffaloes ..	19	3658·4	312·4	140·7	11·7	8·0

During the year under report 4,66,692·3 lbs. of milk were produced. A detailed statement giving the performances of the different herds is given below.

TABLE IV

	April 1941	May 1941	June 1941	July 1941	August 1941	Sept. 1941	October 1941
Sindhi lbs. ...	6854·8	6794·1	6112·7	6171·2	8146·6	8405·0	8736·2
Cows in milk ...	24	24	21	19	23	23	24
„ dry ...	4	4	7	9	6	6	5
Overall daily aveg. lbs.	8·1	7·8	7·2	7·1	9·0	9·6	9·7
Jersey-Sindhi lbs. ...	7703·6	7633·9	5833·5	6917·6	8734·8	8559·6	7920·0
Cows in milk ...	23	21	15	19	23	20	21
„ dry ...	1	3	9	5	1	4	2
Overall daily aveg. lbs.	10·7	10·2	8·1	9·2	11·7	11·8	11·1
Brownswiss-Sindhi } „ -Harriana }	4066·3	4070·2	3684·5	3461·3	3286·1	2991·4	1875·9
Cows in milk ...	8	8	8	8	8	7	6
„ dry ...	0	0	0	0	0	1	2
Overall daily aveg. lbs.	16·9	16·4	15·3	13·9	13·2	12·4	7·5
¼ Holstein-Sindhi lbs. ...	2487·0	1695·4	1459·1	2281·8	2599·3	1685·7	1394·1
Cows in milk ...	7	4	6	7	6	6	3
„ dry ...	0	3	1	0	1	1	4
Overall daily aveg. lbs.	11·8	7·8	6·9	10·5	11·9	8·0	6·3
¼ Jersey-Sindhi lbs. ...	3075·8	3347·2	2588·7	2789·1	3849·0	4317·2	4098·8
Cows in milk ...	9	8	7	9	12	10	11
„ dry ...	0	2	3	2	1	3	2
Overall daily aveg. lbs.	11·4	10·8	8·6	8·1	9·5	11·0	10·1
¼ Brownswiss-Sindhi } „ -Harriana }	4706·7	5896·2	5426·7	5945·2	5462·4	5119·6	5430·5
Cows in milk ...	14	14	13	15	15	18	18
„ dry ...	1	2	3	1	1	0	0
Overall daily aveg. lbs.	10·4	11·8	11·3	11·9	11·0	9·5	9·7
⅛ Jersey-Sindhi ...	...	...	...	...	...	...	...
⅛ Holstein-Sindhi ...	...	...	...	...	...	...	...
⅛ Brownswiss-Sindhi ...	...	...	...	...	...	...	...
Miscellaneous Cows lbs.	5807·5	5525·5	5336·2	5539·6	6027·5	4961·5	5268·3
Cows in milk ...	17	16	15	17	18	17	17
„ dry ...	1	2	3	1	2	2	3
Overall daily aveg. lbs.	10·7	9·9	9·8	9·9	9·7	8·7	8·5
Total Cows lbs. ...	34,692·7	34,962·5	30,441·4	33,106·5	38,106·1	36,040·0	34,723·8
Cows in milk ...	102	95	85	94	105	101	100
„ dry ...	7	16	26	18	12	17	18
Overall daily aveg. lbs.	10·6	10·1	9·1	9·5	10·5	10·1	9·5
Murrah buffaloes lbs. ...	4508·5	4323·3	3530·4	3631·9	7521·7	8538·2	9580·4
Buffaloes in milk ...	14	12	11	15	21	26	28
„ dry ...	8	10	10	7	6	3	2
Overall daily aveg. lbs.	6·8	6·3	5·6	5·3	8·9	9·8	10·3

TABLE IV

Nov. 1941	Dec. 1941	January 1942	February 1942	March 1942	Total production	Monthly Average No. of cows	Overall daily average
7815·4	5884 1	4997·4	4014·6	4295·6	78,218·7		
25	23	23	22	23	...	28·75	
4	6	6	7	7			
9·0	6·5	5·5	5·0	4·6	...	...	7·4 lbs.
7168·8	7201·0	8761·6	7930·0	8312·6	92,677·0		
20	22	22	23	23	...	23·75	
3	1	2	1	1			
10·3	10·1	11·7	11·8	11·1	...	...	10·6 lbs.
1568·0	1389·6	1382·4	1429·5	2136·2	31,341·4		
7	5	5	3	5	...	8·00	
1	3	3	5	3			
6·5	5·6	5·5	6·3	8·6	...	...	10·7 lbs.
1265·5	1916·8	2824·7	2831·6	2794·1	25,235·1		
4	4	5	6	6	...	6·70	
3	2	1	0	0			
6·0	10·3	15·1	16 9	15·0	...	...	10·5 lbs.
4070·7	3809·4	4428·5	3573·9	3577 4	43,526·4		
11	13	12	11	11	...	12·50	
2	1	2	3	5			
10·4	8·5	10·2	9·1	7·2	...	...	9·5 lbs.
3485·4	2420·5	3139 4	4894·6	5233·2	56,660·8		
17	12	12	14	15	...	17·00	
1	5	6	4	3			
6·4	4·6	5·6	8·7	9·3	...	...	9·1 lbs.
...	...	503·4 (1)*	768 0 (2	951·0 (2)			
...	...	366·5 (1)	307·9 (1	325·0 (1)	3232·5		
...	...	...	...	10·7 (1)			
3719·5	4210·3	5596·8	5192·7	4490·2	61,675·6		
15	14	19	17	17	...	18·80	
4	4	1	2	2			
6·5	7·5	9·0	9·7	7 6	...	...	9·0 lbs.
39,093·3	26,831·7	32,000·7	30,442·8	32,126·1	3,92,567·6		
99	93	100	99	104	...	116·20	
18	22	21	22	21			
8·2	7·5	8·5	8·9	8·2	...	...	9·2 lbs.
7598·6	7694·6	7063·6	5355·6	4777·9	74,124·7		
27	25	26	24	21	...	25·90	
2	4	3	5	10			
9·8	8·5	7·8	6·6	4·9	...	...	7·8 lbs.

* Numbers of animals.

(N. R. JOSHI)

Female Young Stock

The following statement gives the number of female young stock in the herd during the year ending March 31st, 1942.

TABLE V

	Number on 1-4-'41	Born during the year.	Transferred to milch stock.	Sold	Died	Number on 31-3-'42
Red Sindhi ..	22	12	5	..	2	27
Jersey-Sindhi ..	3	..	2	1	..	..
½ Jersey-Sindhi ..	28	18	8	.	4	34
½ Brownswiss-Sindhi Brownswiss-Harriana }	12	3	5	..	..	10
½ Holstein-Sindhi ..	2	..	..	..	..	2
1/8 Jersey-Sindhi ..	5	8	2	1	3	7
1/8 Brownswiss-Sindhi	8	9	1	..	2	14
1/8 Holstein-Sindhi ..	10	6	1	..	2	13
1/16 Jersey-Sindhi ..	..	1	..	.	..	1
1/16 Brownswiss-Sindhi. ..	..	1	..		..	1
Miscellaneous cows ..	15	9	5		4	15
Murrah buffalo ..	31	15	12	..	7	27
Total ..	136	82	41	2	24	151

The average age, weight and height at withers at first calving of 41 heifers which, according to the above Table V, were transferred to milch stock during the year, is as follows :—

TABLE VI

Red Sindhi	3·04 Years.	698 0 lbs.	44·2 inches.
Jersey-Sindhi	2·64 „	756·5"	45·6 „
½ Jersey-Sindhi	2·33 „	648·0 lbs.	44 3 „
½ Brownswiss-Sindhi ..	2·49 „	712·0 „	46·2 „
1/8 Jersey-Sindhi ..	2·34 „	629·0 „	42·5 „
1/8 Brownswiss-Sindhi ..	2·20 „	595·0 „	44·7 „
1/8 Holstein-Sindhi ..	2·60 „	680·0 „	45·3 „
Miscellaneous cows ..	2·40 „	663·0 „	44·6 „
Murrah buffalo	3·50 „	1188·0 „	52·0 „

The general health of the female young stock was satisfactory. Data regarding the growth of young animals as indicated by live weights are being maintained. Heretofore our system of numbering the animals was by means of metal ear tags. During the year a tattooing set was purchased and we have started tattooing the animals.

During the year under report three Sindhi bulls were sold to Assam Government.—*N. R. Joshi.*

Artificial Insemination

A limited number of cattle and goats were impregnated with sperm collected by means of the artificial vagina. We have one Jersey-Sindhi crossbred bull and one purebred Red Sindhi bull that we have trained for easy collection of spermatozoa. Several of our Jumnapari bucks are also good contributors.

This manipulation of artificial insemination has a three-fold value in our programme. We give practical demonstrations for our advanced Animal Husbandry and Dairying students; we use it for impregnating cows and goats that are suspicious for some disease which may be transmitted to the bull or buck; and we are able to use certain males more extensively during the breeding season. In one instance four goats were inseminated with the sperm from one buck in an elapsed time of ten minutes. This would have been impossible under the natural method.

We have seven young goats in our herd that have been produced by this method. It so happens that one is a female and six are males. Two of the males are twins. One kid weighed eleven pounds at birth and all appear normal in every way.—*T. W. Millen.*

Goats

The popularity of our Jumnapari goat herd has increased during the past months and many goats are being brought for service from the surrounding area, some from distances of several miles. The only females which we have sold were those which were taken over by the Rural Development Association. We have at present sixteen female kids all of which we plan to take into the herd. Our present policy is to keep all females for at least two lactations and to maintain as high a milk yield in the herd as we are able to build up by selection and line breeding.

A number of males have been sold and fourteen more male kids are still for sale. Many of the characteristics of the Jumnapari are dominant over those of the local desi goat which makes these bucks of special value. First generation hybrids are often difficult to distinguish from the purebreds. One characteristic which the local goat breeders seek and secure in these crosses is a much larger goat than that now present in the district.—*T. W. Millen.*

Sheep

The Institute maintains a flock of white, fine-wooled sheep headed by a Hissardale ram which we purchased from

Hissar last year. There is some Merino blood in our flock and we have some ram lambs born each year which show very good fleeces. We have had considerable demand for these rams for improvement of desi flocks.—*T. W. Millen.*

Poultry

Our poultry flock consists of White Leghorn and Rhode Island Red fowls. Most of the birds are under one year of age. We have made some attempt to determine whether it is possible and profitable to hatch eggs all year round. We have now hatched chickens in all months except June, but find that they appear to grow better during cooler months. We have been able to supply the demand for breeding cocks and setting eggs, but have not been able to supply female stock. We hope that within a few months hens and pullets of both breeds will be available for sale.

All our eggs are hatched in small incubators and the chicks raised in electrically heated brooders. The chicks are several weeks old before they are allowed on the ground. These methods eliminate many of the diseases and parasites which accompanied the desi hen when she was used to incubate the eggs and raise the chicks.—*T. W. Millen.*

Bees

The Institute Apiary has kept at the same time six strains of bees, namely:

(1) Apis dorsata, (2) Apis indica (hills variety).

(3) Apis indica (plains variety), (4) Kashmir bees.

(5) Apis florea and (6) the dammar bees (Melipona app.)

For the rock bees we developed a cage having perforated sides. These perforations permitted the workers to pass freely, but confined the queen. One colony made a fine comb and reared considerable brood during the four months we kept it in this cage. This is the first time this bee has been kept working in a confined cage and a world record for keeping a dorsata colony after removing it from its original

location. We were able to study these bees considerably and isolated several queens of the species. A similar cage is used for Apis florea, but with much smaller perforations.

Honey extracted from a dorsata comb by means of the solar honey extractor and preserved immediately in glass containers could not be distinguished from that secured from combs of Apis indica at the same season. We are convinced that the greatest factor responsible for the inferior quality of rock bee honey is the method of processing and storage which is in general use.

We have postponed the importation of foreign queens until more favourable times and are confining our efforts to the maintenance and propagation of the Indian bees under Allahabad conditions.—*T. W. Millen.*

(*Continued from page* 319)

the river and visitors in the hostel on Sundays all add variety which is sought for in a school programme. But on ordinary evenings during sports and walks the girls seem to be very happy and the staff report that we are all enjoying their work and are glad that we are growing. The eagerness with which parents have tried to get their girls into our Home-Making Department has shown us that we are growing in popularity and that there is a realisation of the usefulness of our course.

We sent up 11 girls for the E. T. C. examinations and out of that number 10 passed, one 1st division in practice, two 2nd division in practice. The girl who failed did so in only one subject. The Home-Making course was taken by all girls in addition to the E. T. C. during the 2 years of study. We hope that the Intermediate course will be recognized permitting girls to go to the University for the newly planned Degree of B. Sc. in Home Economics or of remaining a year longer with us for their I. T. C.

REPORT OF THE DEPARTMENT OF BIOLOGY, 1941-42.

By W. K. Wesley

Staff.

Edgar F. Vestal (on furlough), Botany and Plant Pathology.

W. K. Wesley, Zoology and Entomology.

T. A. Koshy, Biology.

A. D. Chand, Plant Pathology.

T. W. Millen, Bacteriology.

General.

On the departure of Dr. E. F. Vestal for furlough, Mr. W. K. Wesley was appointed the officiating Head of the Department. Mr. A. D. Chand took over the teaching of Plant Pathology, and Dr. T. W. Millen of Bacteriology.

Besides the regular students, we gave training to several casual students from outside.

Botany and Plant Pathology.

An attempt was made to grow tapioca (*Manihot utilissima*) which met with considerable success. Besides being a food crop this is also a valuable source of starch. Efforts are being made to introduce several varieties to find out those which will be most suited to this region.

Cultures of fungi isolated from diseased plants on the Institute Farm, and reported last year, were maintained. Besides these some cultures were obtained from the Allahabad University and Imperial Agricultural Research Institute, New Delhi, for use in Plant Pathology work.

A culture of an isolation from guava about which a brief report was given last year, was sent to the Imperial

Mycologist, New Delhi, who very kindly identified it for us as a *Cephalosporium* and reported that as far he knows this fungus has not been previously recorded on guava in India. The culture is being maintained at the Imperial Institute as well as here.

Entomology.

Special observations were made on the life histories of the following four beetles and a moth which cause damage to the stored wheat and wheat flour in Allahabad and the neighbouring districts. These beetles (Coleoptera) are known as *ghun* in Hindustani, weevils in English, kornwurm in German and charancon in French.

1. The Rice Weevil or Sund wala ghun. (*Calandra oryzae* L. Curculionidae).

2. Khapra ghun, (*Trogoderma khapra* Arr. Dermestidae).

3. The wheat weevil. (*Rhizopertha dominica* F. Bostrychidae).

4. The red grain beetle or Lal ghun. (*Triboleum castaneum* M. Tenebrionidae).

5. The grain moth. (*Sitotroga cerealella* Oliv. Gelechidae).

Sund wala ghun.

This *ghun* is a dark brown insect with a snout (sund). It is one-eighth of an inch long and possesses club-shaped antennae which are elbowed. The upper surface of the thorax and the elytra is pitted. It is a major pest of stored rice as well as of wheat and other stored grains. It is commonly found all over the world and has been reported from almost all the important places in India Its activities are much accelerated during the warm season.

This *ghun* may live up to eight months and cause considerable damage. The mated female lays small, whitish, oval eggs on the grain after scooping out a little bit of the

seed coat. The grub* hatches in a week or so and entering the grain starts feeding on its contents. When full fed in about two to three weeks the larva is as long as the adult and pupates within the grain as a dirty white pupa which turns dark brown in a week when the adult comes out.

Khapra ghun.

Khapra is a small dark brown *ghun* with a retractile head and clubbed antennae which are attached in pockets on the lower side of the thorax. The female *ghun* is one-tenth of an inch long and bigger than the male. These insects are very common here as well as all over India. In the absence of wheat they feed on other grains also. During the hot months the mated females lay small white eggs on the grain which hatch in about a week. The reddish brown hairy larva banded with yellowish brown colour and possessing a long bushy tail feeds on the grain and is full fed in about three weeks or a month when it pupates among the grain as a dark brown object. Within a week the adult is fully developed and comes out. It is most destructive during the rainy season when it abounds mostly in the upper layers of the stored grain.

Gehun ka ghun.

This *ghun* is about one-eighth of an inch long. Its colour varies from brown to brownish black. The head is deflexed and covered by a crenulate hood-shaped pronotum. The antennae are clubbed which are tripartite. This *ghun* is also quite common here as well as elsewhere in India. It has been reported feeding on a variety of materials *e.g.*, biscuits, wood, etc., but it is very destructive to stored wheat whenever it finds access to it. The fertilized females lay a large number of small white eggs early in the summer season on the grain which hatch within a week or more depending upon the temperature. The larva which feeds inside the grain is full fed in about two months when it is

*The first stage in the life history of a beetle is known as an egg, the second stage as a grub (larva). The larva stage is the stage of feeding and growth in insects. When full fed the larva changes into a pupa which does not feed but during this period of time metamorphoses into the adult beetle.

as big as the adult. It is cream coloured with constricted abdomen and light brown head. The pupa is light brown which is also formed inside the grain. The adult is more harmful than the grub and is at its worst in the rainy season.

Lal ghun.

This *ghun* is about one-sixth of an inch long and red to reddish brown in colour. It is very common in wheat flour and in grain that has been attacked by other insect pests. It has also been seen attacking pistachio nuts. The affected flour starts smelling bad and the preparations made from this flour are also distasteful and unwholesome. The female *ghun* lays small whitish eggs in the flour which hatch in about three days into elongated, cream coloured hairy larvae very common in the rainy season. They feed on the flour and pass the excreta in it for about three weeks when they become full fed and pupate. The pupa case is also cream coloured from which the adults come out within a week.

The Grain moth.

This moth is a very bad pest of stored grains, *viz.*, wheat, maize, rice, and juar. The moth is straw coloured with a satin lustre and a wing expanse of about three-eighths of an inch. The wings are delicate, pointed and fringed on the hinder margin with fine hair. The head and the thoracic regions are dark brown. The antennae are long and slender. The eggs are small, rounded, white at first, changing to pink colour later on and are laid on or near the grain. They hatch in about a week and the newly hatched caterpillars bore into the grain where they feed on its contents. They are full fed in about two weeks and pupate within the grain in a silken cocoon. After about a week the moths come out and mate. The moths are quite harmless and short-lived and are seen coming out in large numbers.

Fumigation with carbon bisulphide or calcium cyanide has met with some success in controlling these pests.

(*Continued on page* 350)

REPORT OF THE DEPARTMENT OF AGRICULTURAL ECONOMICS, 1941-42

By

Dr. Sam Higginbottom and H S. Azariah.

Personnel:—Mr A. Dayal Chand was assisting in the department till October, 1941, when he was relieved by Mr. Henry S. Azariah. Mr. Azariah returned to the Institute after two years of advanced study in Agricultural Economics and Rural Sociology in Cornell University (U.S A.). He was granted the degree of M.Sc.

Educational Activity:—The main work of the department is teaching. About two years ago, a course in Principles of Economics was introduced to the first-year class; and, last year, a course in Agricultural Economics to the third-years. Formerly the second and the fourth year classes received instruction in Economics: now, all the classes are studying the subject, and, therefore, the distribution is much better. It will take some time before the benefit of this arrangement can be seen in the results of the final University and the Board examinations.

Compared to last year, the results of the final examinations were very good All the students passed successfully in Agricultural Economics in the final university examination. In the Intermediate Board examination, however, three out of thirty-three failed to pass in Principles of Economics. These students failed also in more than one subject.

Unlike some other Indian Universities, the teaching of Farm Management is under this department. Farm management to-day is recognised as a part of Agricultural Economics. Pedagogically, this arrangement has been found very helpful.

Research:—Until last year little research was attempted by this department. This does not mean that the department was not aware of the importance of such work. Unfortunately, it neither had a sufficiently large personnel nor the necessary funds to undertake much special investigation. Research in Agricultural Economics is a necessity. The information obtained from any project will be useful not

only to the student but also to the farmer. Factual data to illustrate the principles in Agricultural Economics, and especially in Farm Management are sadly lacking in India. A great deal has been written by arm-chair investigators or by economists who have little first-hand knowledge of Indian agriculture, and, these frequently state "opinions" which often differ from the facts. Teaching cannot be done efficiently, unless more time is given to research Sometimes the need may not be so much for getting original data, as for organizing and analyzing that already available. The department with the help of Mr. C. V. Thomas, a B.Sc. student and a member of the labour crew, calculated the index of seasonal variation in the price of wheat, rice, gram, arhar dal, cotton, linseed, maize, barley, and sugar (raw) in the United Provinces. These calculations and the charts are based for the ten-year period of 1931-40. It may be noted that the seasonal variation of some commodities as found in the Marketing Reports of the Imperial Council of Agricultural research, are based for the five-year period of 1931 to 1935; and, therefore the result obtained by this department is of additional value. A report of this work will be published soon so as to make it available to those interested. Dot maps are also being prepared for the United Provinces showing the distribution of various crops and livestock. These dot maps show the concentration of various enterprises in the different parts of the United Provinces; and for teaching purposes, these will be of value.

A great deal needs to be done in this field: but the greatest handicap just now is the lack of adequate funds. Most of the work involved in the statistical analysis of factual data cannot be done efficiently without an adding machine. Such data will be useful to the student, the farmer and the government

The Institute itself is a suitable project for research into many aspects of farm economics. It has a record of accounts with every crop and every field for the last fourteen years. It also has records of cost of production of mills. It has tried out many implements and methods to see whether crop increase is possible. It has experimental plots. Were all the material here available subjected to economic analysis and interpretation much valuable factual material might be brought to light

REPORT OF THE CHEMISTRY DEPARTMENT, 1941-42.

By

A. P. Brooks

Staff:—The Chemistry Department staff has remained the same throughout the year Mr. Brooks continued in charge as head of the department, Dr. B. B Malvea, of Ewing College, continued to give lectures in advanced theoretical chemistry, while Mr. C. O Das and Mr. J C. Gideon had charge of the laboratory work and of lectures for beginning classes.

Equipment and Supplies:—The department was fortunate in having had on hand nearly a sufficient amount of the larger pieces of apparatus needed to carry on the regular work Several pieces of apparatus needed to ease congestion and help out a little were ordered nearly two years ago but delivery has not yet been secured, and now seems doubtful for the period of the war. The laboratory has also had on hand sufficient supply of glassware and chemicals so that the normal activities have not had to be curtailed. However, replacements orders for the forthcoming year have been difficult to fill, and there may be a shortage of a few items.

Inability to secure new equipment and special reagents has limited the ability of the laboratory to undertake certain investigations or research which would have been desirable.

Activities:—The department is mainly concerned with routine teaching. In all, six classes of chemistry are taught, each with its requisite amount of lectures and laboratory work. This includes two classes of Intermediate chemistry, two classes of B Sc. Agriculture chemistry, one class of B.Sc. Dairy chemistry, and one class of I D.D. Dairy chemistry. In addition facilities are offered to the Home Making Department to give the girls instruction in a certain amount of chemistry in connection with their courses in foods, nutrition,

and cooking. The department provides an average of about fifteen hours of lectures and twenty hours of practical work per week. It is estimated that every hour of practical class work requires more than an hour and a half of preparation on the part of the staff. This is particularly true of the advanced courses in agricultural analysis where many accurately standardized solutions are needed and where many samples of analytical material have also to be analyzed by the staff in order to ensure accuracy and to check the student results

In addition to teaching activities the department is interested in carrying on such research and minor investigations as it has time for and is able to undertake with the facilities at its disposal. During the past year several samples of water have been investigated. Samples of compost and manure were analyzed for nitrogen, phosphorous and potash. Several samples of pure *ghee* and vegetable *ghee* have been investigated for purity and their chemical constants determined. In this connection we have also been accumulating data on the constants of pure cow *ghee* and pure buffalo *ghee* from the Institute herds in order to eventually learn the limits of variability of cow and buffalo *ghee* of our herds. The constants usually determined are the Reichert Meissl number, the iodine number, and sometimes the saponification number.

In the late spring we were asked to co-operate with Government in the investigation of certain soils in connection with military requirements for aerodrome sites. The department was able to aid in the determination of the pH and other characteristics of various soil samples brought in for test.

Samples of limestone from Kashmir and Jaipur were analyzed in detail to serve as samples for student practical work. As a side line five collections of geological specimens were assembled and mounted and carefully labelled for display at the farmers' fair and on other suitable occasions. Two of the fossil collections are unusually complete and one at least may be presumed to be superior to any other of its kind in India.

UNITED PROVINCES DEPARTMENT OF AGRICULTURE—MONTHLY AGRICULTURAL REPORTS

MAY, 1942

I—Season.—Rainfall during the month was general but unevenly distributed. Many districts received no rain at all. It was heavier in the 2nd and 4th weeks than in the 1st and 3rd weeks. It was above the normal in three districts, the district of Dehra Dun topping the list recording above 2 inches.

II—Agricultural operations.—Agricultural operations are generally up to date. Irrigation of sugarcane and extra crops and preparation of land for kharif crops are in progress. Sowing in canal-irrigated areas has started.

III—Standing crops and IV—Prospects of the harvest.—The condition of the standing crops and the prospects of harvest are, on the whole, satisfactory.

V—Damage to Crops.—Slight to moderate damage to crops by hail is reported from the Meerut, Bulandshahr, Lucknow and Hardoi District. Loss to crops amounting to about Rs. 1,566 and Rs. 1,13,200 respectively is reported from fire in the Naini Tal and Kheri districts. To a lesser extent, damage by fire is also reported from the Bulandshahr, Pilibhit and Hamirpur District.

VI—Agricultural stock.—Cattle diseases are reported from some of the districts, but the condition of agricultural stock is, on the whole, satisfactory. The figures furnished by the Director of Veterinary Services, United Provinces, tabulated below when compared with those of the last month indicate more seizures and deaths by rinderpest and haemorrhagic septicæmia during the month under report. Seizures and deaths by foot-and-mouth diseases are on the decline:

Disease.	April, 1942		May, 1942	
	Affected	Deaths	Affected	Deaths
Rinderpest	808	562	925	565
Foot-and-mouth	6,137	26	5,023	7
Hæmorrhagic septicæmia ...	122	117	207	178

VII—Pasturage and fodder.—No scarcity of either pasturage or fodder is reported from anywhere except in the Agra and Mainpuri Districts.

VIII—Trade and prices.—There has been a somewhat marked fluctuation in the prices of barley and *arhar dal* though the prices of wheat, gram and rice have been more or less stationary with a slight rising tendency. A comparative statement of the retail prices, in rupees per maund prevailing at the end of last month and at the end of the month under report is given below :

	End of April, 1942	End of May, 1942.
Wheat	5·311	5·619
Barley	3 262	4·039
Gram	4·011	4·537
Rice	7·235	7·583
Arhar dal	5·522	6·116

IX—Health and labour in rural areas.—The condition of the rural population is generally satisfactory. Outbreaks of small-pox are reported from the Etah, Shahjahanpur, Pilibhit, Ghazipur, Azamgarh, Lucknow and Fyzabad Districts. Stray cases of plague and cholera have also been reported.

JUNE, 1942

I—Season.—The first week of June, 1942, was practically rainless. Light showers of rain were received in certain districts during the second week, and the rainfall was liberal throughout the province in the 2nd fortnight of the month. It was above the normal in 17 districts, the Naini Tal District recording the highest rainfall of 11-12 inches. More rain is still needed.

II—Agricultural operations.—Agricultural operations are in full swing. Irrigation of sugarcane and paddy continues. Weeding of sugarcane, paddy, cotton and maize is

in progress in certain districts. Preparation of land and sowing of kharif crops has also started.

III—Standing crops and IV—Prospects of the harvest.—The condition of the standing crops and the prospects of harvest are, on the whole, satisfactory.

V—Damage to crops.—Slight damage to crops by locust resulting in a loss of 2 annas in a rupee is reported from the Muttra District. Loss to crops amounting to about Rs. 13,136 and Rs. 58,323 respectively is reported from fire from the Hamirpur and Kheri Districts. To a lesser extent, damage by fire is also reported from the Pilibhit and Cawnpore Districts

VI—Agricultural Stock.—Cattle diseases have been reported from some districts, but the condition of agricultural stock is, on the whole, satisfactory. The figures furnished by the Director of Veterinary Services, United Provinces, tabulated below when compared with those of the last month indicate less seizures and deaths by Rinderpest, Foot and Mouth and Hæmorrhagic Septicæmia during the month under report :

Disease	May, 1942		June, 1942	
	Affected	Deaths	Affected	Deaths
Rinderpest	925	565	773	473
Foot and mouth	5,023	7	2,061	5
Hæmorrhagic Septicæmia ...	207	178	206	172

VII—Pasturage and fodder.—No scarcity either of pasturage or fodder is reported from anywhere except in the Muttra and Farrukhabad Districts.

VIII—Trade and prices—There has been a somewhat marked fluctuation in the prices of wheat, gram and rice though the prices of barley and *arhar dal* remained more or less stationary with a slight tendency to rise. A comparative statement of the retail prices in rupees per maund prevailing

at the end of the last month and at the end of the month under report is given below :

	End of May, 1942	End of June, 1942
Wheat	5·619	6·223
Barley	4·039	4·790
Gram	4·537	5·159
Rice	7·583	8·299
Arhar dal	6·116	6·995

IX—Health and labour in rural areas.—The condition of the rural population is generally satisfactory. Outbreaks of small-pox are reported from the Ghazipur, Azamgarh, Lucknow, Kheri and Fyzabad Districts. Stray cases of cholera have also been reported.

(*Continued from page* 342.)

Other pests. Other observations made were as follows:—*Oxyrachis tarandus* was observed on carandus besides brinjal.

In addition to the common food plants *Zunabris pustulata* T. was also seen damaging salad and citrus leaves.

Casual observations recorded on *Diaphorina citri* Knw. were published in "The Allahabad Farmer" Vol. XVI, No. 2 March, 1942 *

Life histroy of *Leucinodes orbonalis* G. was observed on brinjal and the observations published in "The Allahabad Farmer" Vol. XVI No. 4, July, 1942*

Nephantis serinopa M was collected from palm leaves. Further observations are carried on.

A special collection of Papilionidae of Allahabad is being carried on and the work will be published as soon as it is in shape.

* The articles have also been reprinted in the United Provinces Fruit Journal [Editor.]

REVIEW

THE PRESERVATION NUMBER

(*The* 1942 *Annual Number of the Punjab Fruit Journal*)

Foreword by the Hon'ble Rao Bahadur Ch. Sir Chhotu Ram, Minister for Revenue, Punjab.

Edited by S. B. S. Lal Singh, Fruit Specialist, Punjab, Lyallpur

and

Dr. Girdhari Lal, Bio-Chemist, Fruit Products Laboratories, Lyallpur.

Available from The Punjab P. C. Fruit Development Board, Lyallpur.

"There is an extreme dearth of authentic literature dealing with fruit and vegetable preservation pertaining to Indian conditions, as books written by foreign authors do not fully answer our purpose. There was, consequently, a keen demand for the publication of suitable literature on the subject. And this demand has been still further intensified by the present war inasmuch, as importation of foreign products has almost completely stopped, there is need for local production, and in fact, a rare opportunity to develop this industry when it can have a normal chance of survival without being strangled by foreign competition."

Keeping the above in view, the Punjab Fruit Development Board, which has earned a reputation for bringing authoritative literature on gardening suitable to Indian conditions, has devoted the fifth Annual Number of the Punjab Fruit Journal exclusively to the Fruit and Vegetable Preservation Industry. We congratulate our contemporary in completing its first quinquennium and for establishing itself as a successful venture in horticultural journalism in the East.

This compendium will surely be of immense use to those who are interested in Fruit and Vegetable Preservation and will be welcomed alike by research scholars and commercial magnates.

It is a handy illustrated Annual comprising seventy (70) pages replete with facts essential for starting the Preservation Industry both as a war and post-war measure. Some of the most informative articles in this 'souvenir' are:

Future of Fruit Preservation Industry—War and the Preservation Industry—Facilities for Training in Fruit Preservation—Equipment for a Fruit Preservation Factory—Preparation of Citrus Fruit Squashes and Cordials—Preparation and Preservation of Unfermented Apple Juice—Preparation of Jam from pears and plums—Tomato Ketchup—Tomato Juice—Guava Cheese—Pickling of Vegetables—Drying of Vegetables—Vinegar Manufacture for Home Use—Control of 'Spoilage' in Canned Foods—Summary of the work done in Fruit and Vegetable Preservation at the Fruit Products Laboratories, Lyallpur—Directory of Firms Supplying Fruit Products and Fruits.

This Number is priced at Re. 1-8 including postage on pre-paid Money Order basis or V.P.P. basis; but to regular subscribers of the journal and the members of the Punjab Fruit Development Board, this Number along with other issues of the journal is supplied free. The Annual subscription of the journal is Rs. 3 on pre-paid Money Order basis and Rs. 3-8 per V.P.P. basis.

NOTE:—Popular abridged Urdu Edition of this Special Preservation Number, comprising 40 pages of the reading matter priced at Re. one including postage on pre-paid Money Order basis or V.P.P. basis, is also available for sale.

For further particulars please write to—

THE HONY. SECRETARY,
Punjab P. C. Fruit Development Board, Ltd.
Punjab Agricultural College, Lyallpur (India)

Registered No. A-925

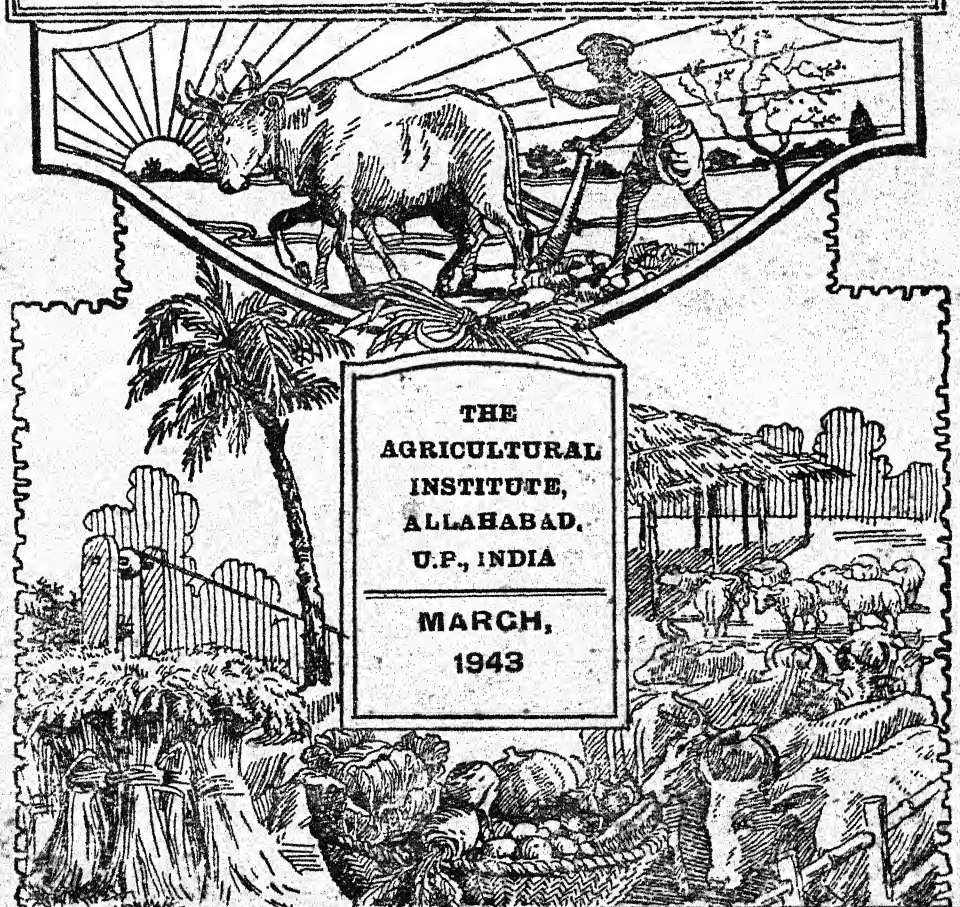
VOL. XVII] [No. 2

ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life



THE AGRICULTURAL INSTITUTE, ALLAHABAD, U.P., INDIA

MARCH, 1943

"The wealth that makes a nation really strong and not merely rich is the opportunity for industry, intelligence, and well-being of its labouring population."

—Dr. B. Pattabhi Sitaramayya.

THE ALLAHABAD FARMER

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

The Allahabad Farmer is now approved by the Directors of Public Instruction in the United Provinces, Bengal, Central Provinces, Sind, Assam, Bihar, and Orissa, the Rural Reconstruction Commissioner, Punjab, and by the Director of the Institute of Plant Industry, Indore, and Agricultural Adviser to Rajputana and Central India States, for use in all schools under their jurisdiction.

Subscription Rates

Annual subscription : India, Rs. 3; England, 4 shillings; U.S.A., 1 dollar. Single copies, 10 annas; over five years old, 12 annas. Copies which are not received by subscribers will be supplied free of cost within six months of the month of issue. Thereafter single copy prices will be charged.

Unused portions of subscriptions cannot be refunded.

Advertising Rates

	Rs.	a.	p.
One full page of six numbers	35	0	0
One single full page	7	0	0
One half page of six numbers	20	0	0
One single half page	4	0	0
Page 2 or 3 of cover for six numbers ...	50	0	0
Page 4 of cover for six numbers	70	0	0

Contributions

The Allahabad Farmer is published in the first week of each alternate month commencing with the month of January. Contributors are requested to send in their articles at least one month prior to the next prospective date of publication.

Contributors will receive 15 reprints of the article published and additional copies at cost.

Publisher—The Allahabad Agricultural Institute, Allahabad, U.P. (American Presbyterian Mission).

Printer—The Mission Press, Allahabad, U. P.

Business correspondence should be addressed to the Business Manager, Allahabad Farmer.

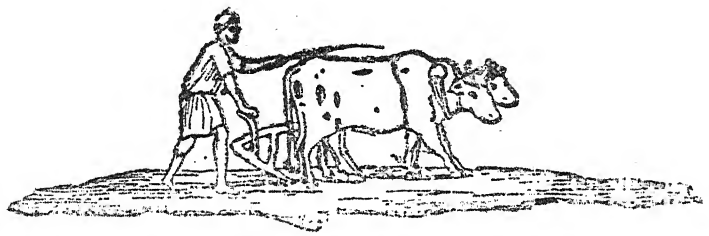
The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

Vol. XVII] MARCH, 1943 [No. 2

Table of Contents

THE ALLAHABAD FARMER



VOL. XVII] MARCH, 1943 [No. 2

Editorial

Grow More Food.

When one considers the advantages that India has as an agricultural country, it is little short of a tragedy that there should be any shortage of food in India. My observation leads me to believe that the present shortage of food in India is not so much because the food is not in India, but many people who were accustomed to have not more than two to three weeks' supply in hand, have been able to secure a supply to last much longer. No matter what the cause, there is today a supply of available food short of requirements.

How to grow more food has become for many people a live question. What can the ordinary village farmer do to secure more food for himself and his livestock and have a greater surplus for city-dwellers ? In the first place, if he does not keep a manure pit he should immediately have one, into which all animal manure, all leaves and stubble of every kind should be placed, all household wastes including night soil should be included. A sanitary latrine can be installed over one corner of a manure pit by placing a beam of wood across one corner and putting two small boards across it with space in between. Any kind of grass chappar round it, *sarpat* or *bajra* or *juar* stalks, would do. If the family would use this instead of the fields, not only would the manure be much richer, but disease would be prevented.

A handful of dry earth after each using or cattle manure or ashes thrown over this would prevent flies and would also deodorize it. This compost should then be carried to the fields and spread over evenly and ploughed in with very greatly increased crop yields. I go into many villages where no effort has yet been made to instal manure pits or to clean up the village. If the Rural Development Association, Boy Scout, Better Living Societies, Government officials, any public-minded person, could persuade the village to clean up all its wastes, especially the urine-soaked earth from where the cattle have stood, appreciable increases in yield would result. I am convinced by experiment that from fifteen to 30 per cent greater yields could be secured by just cleaning up the village wastes which are now left to blow about as dust which cause disease.

After many years' experience in India, I find two kinds of farming to be very poor farming. First, to attempt to farm in the monsoon areas of India without irrigation water. The second to farm without manure. One reason that irrigation water has not done all that was expected of it in many parts of India has been that the farmer has thought that water alone was sufficient Irrigation water without the application of manure will more quickly reduce the available fertility of the soil by taking greater crops at first. On very few soils anywhere in the world is irrigation water alone as g od as irrigation water and manure. The Agricultural Institute for fully twenty years has had sewage irrigation for a hundred acres. Sewage irrigation is not all that it is sometimes acclaimed. The constant application of sewage water seems to bring about some physiological disarrangement of the plant-food I compare it to a person nibbling at food all day rather than sitting down at regular intervals to properly prepared meals. The constant nibbling is almost certain to upset the digestion, whereas tho regular meals with the same amount of food will maintain the person in full health and strength. Then sewage water also seems to adversely affect the keeping quality of crops raised. There is also danger to health from the eggs and larvae of intestinal parasites. It is questionable whether the public health authorities of India should permit the use of untreated

sewage water. If sewage water were properly treated, it has valuable fertilizi' g value, but as applied in many places now a survey of the workers on the sewage farms shows a very high parasitic infection

It is reported that a recent survey of India shows that only a fraction of its available water supply is used for irrigation. Much water that falls should be conserved in tanks and large storage reservoirs instead of being allowed to run off carrying with it the valuable top-soil In flat country where it is not possible to put in tanks, small streams could be dammed at suitable places and this water saved from the rains could be lifted on to the land for the winter crop. Many wells could have their yield of water doubled or more, through boring. The Agricultural Department of the United Provinces has a special section devoted to well boring. The simple cleaning out of the accumulated debris from many wells would greatly increase the amount of water available from them. Two years ago in the Meja Tehsil, cattle were being driven daily six to eight miles to get water Most of the big village tanks were dry; many of the villagers were digging out the mud from the bottom of these dried up tanks and putting it on the side. They were in many cases extending the area of the tank thinking that this would increase the amount of water available. In seven years out of eight many of these tanks had water in them throughout the year, though it got very low in May and June before the monsoon. But the eighth year there was no water after late April. An experienced irrigation engineer once told me that the surface evaporation from a sheet of water in this part of India was from ten to twelve feet a year. That meant that if you had a body of water ten to twelve feet deep, at the end of the rains, even if no water soaked into the ground or was used by the people or cattle for drinking or other purposes, that most of that water would be gone before the next rains. I pointed out to the village people that if they wanted to make sure of water during a very dry year it was not to extend the area of the tank but to deepen the existing tank. Tanks that were up to twelve feet deep are liable to be absolutely dry in the hot weather as stated above. If these tanks could be deepened in places even up to twenty feet, water would be saved for the

use of animals and irrigation purposes About a week ago, I visited a village which had a very large tank, and which had about ten bighas of sugar cane. It took eighteen men in three lift stages to irrigate one bigha of sugar cane. Even at low village wages they told me it took two days and cost not less than ten rupees in cash wages. As six waterings were needed, this sugar cane is greatly handicapped. There is needed some cheap water-lift for lifts of this kind. If a bullock drive could be used it would greatly cheapen the cost of irrigation.

Again, I find that another great hindrance to the "grow more food" campaign is the lack of transport facilities. Within the last month I have been in villages unapproachable by a wheeled vehicle; everything that is brought in or taken out is either by headload or pack animals—the two most expensive forms of transport known. If the villagers would make themselves a road connecting with a main road the cost of transport would be greatly reduced, the time of transport would also be reduced, and fruits and vegetables and milk not now available to the village and city dwellers could be more easily and cheaply transported.

One final word: Every village farmer should grow enough vegetables for his own family use. He can do this on a plot of ground thirty feet square, if he put his bathing platform on one corner of this and the water used for bathing himself and the members of his family were used for irrigation water and also the waste water from washing utensils. On this little plot could be grown beans, *sag* (green or pot herbs), spinach, cauliflower, eggplant, lady fingers and, in fact, an amazing variety of both temperate zone and tropical zone vegetables which make this part of India the vegetable grower's paradise. A few papaya trees could also be grown. They are one of the easiest things to grow, demanding a little manure and water during the hot weather. Few things are richer in vitamins than this.

If what I have said here were practised the increase of food in India could easily be more than fifty per cent with greatly increased health and strength for the villager.

SAM HIGGINBOTTOM.

ENGINEERING ASPECTS OF A PERMANENT AGRICULTURAL POLICY FOR INDIA

By

Mason Vaugh

There has been public and Governmental interest for three quarters of a century in improving Indian agriculture. It has been recognised that a large part of the Indian population has, at best, a diet inadequate both in quantity and in quality. While it is true that considerable areas are now devoted to producing non-food crops, these crops are necessary for internal consumption or for maintaining India's foreign trade with which she secures needed supplies. Irrigation systems, among the finest in the world, have enlarged the area available for cultivation and have given a measure of security against crop failure due to irregularity of the monsoon which has largely made famine on the old scale an impossibility. The research work of the agricultural departments has made available improved varieties of crops which have materially increased the production of food, fodder and fibre over large areas of India. Substantial progress has been made in improving the cattle of India and in making their products available to larger numbers at reasonable prices and under sanitary conditions. These achievements and others not mentioned have been of great value to India and their effect has not yet reached the maximum. It is not intended that anything which may be said later in this paper should minimise or belittle these achievements.

Before we can adequately discuss the engineering aspects of a permanent agricultural policy, we should have an idea of the objectives of such a policy of what the policy should try to accomplish. A necessary prelude to any accomplishment is a clear idea of what we want to do. Before we buy a railway ticket, we have to decide on our destination. A detailed discussion of the aims of a permanent agricultural policy for India is outside the scope of this paper. The subject is complex and has many aspects but perhaps we can state simply and briefly some, at least, of the major objectives we should have in mind and such a statement will be of help to us in understanding the further development of the ideas to be presented.

A permanent agricultural policy should aim at providing a sufficiency of agricultural products for the needs of the country, at least in so far as they can be economically produced in the country. This would include not only food but fibre and fodder crops, and not only crops for internal consumption but crops for export as well, where the exchange of products with another country is the most economical way of satisfying wants.

It should aim at a balance between cheap and plentiful food and other products for the industrial population on the one hand and a standard of living for the rural population comparable to that of the urban population on the other.

It should aim at the development of the highest standard of living possible for the whole population, urban and rural. (In this discussion the term "standard of living" is used to refer to the sum total of conditions which make life good and enjoyable, not only to the amount and quality of material goods available for consumption.) This means that all classes should benefit equally and that the good of one class should not depend on the depression of another class.

A short review of simple economic principles may help to simplify further discussion and to provide a background for other ideas. The following is an attempt to state briefly and simply some economic truisms. Because they are truisms, they are no less true or important.

First let us define the term "standard of living" as being measured in terms of the volume or value of the products of human labour available to the individual for use or consumption. The "products of human labour" include not only material things or goods but also *services* which contribute to his comfort, convenience, and spiritual as well as material well being. A high standard of living then would include the services of school teachers, authors and poets, religious and political leaders and even such intangibles as leisure.

As a long time proposition we can consume only what we produce. Borrowing for consumption can be only a temporary expedient. We can consume more than we produce at a specific time only if we have previously accumulated or if we take from others part of their production

without due payment. We may consume less than we produce in any given period and so accumulate for future consumption. We can individually produce all the commodities and services which we use or we may exchange our production with others. A truly high standard of living can only be achieved when the exchange is approximately equal. If we give less than we get in a business deal there are spiritual losses which make the exchange unprofitable to the one who profits at the expense of another. This does not refer to philanthropic gifts for the public good or for private charity.

If the above is true, the standard of living is a function of the production per worker. If the total production of wheat or rice or sugar or of any other agricultural commodity is divided by the number of inhabitants consuming the particular commodity, the result will be the maximum amount which can be consumed by each individual sharing equally. I may get more than my share and you less, but collectively we can only consume what is produced and no more. One who is favourably located may produce more than his needs of one or more products and exchange the surplus with another for desired products which the other can produce easily. In this way they both may be better satisfied but they together have only consumed collectively what they collectively produced. Trade, whether local, province-wide, national or international, is only an expansion of this simple operation of one exchanging his excess production with another.

All production, whether agricultural or industrial, depends on the application of power to materials. The power may be human, animal or mechanical; the materials may be soil, water, or other natural resources of any kind. Natural resources are valueless till they have been made available by the application of power and intelligence. Therefore, the production of a worker is a function of the power controlled by a worker, that is, the greater the power controlled by each worker the greater his production can be. Tools and machines are means of applying power to materials so it is equally true to say that production per worker is a function of the extent to which tools and machines are used

in production. Of course it is true that the richness of soil, the selection of crops to be grown and many other factors affect the amount a worker can produce from agricultural work but on any given soil and with any given selection of crops, the amount of production will be directly related to the use of tools and machines. A man can gather wild fruits, seeds and roots for his use. By the use of his bare hands and nails, some area of ground can be dug up sufficiently to plant seeds under conditions which will allow germination. By the use of a stick broken from a bush or tree, the area of ground broken up and the effectiveness of breaking it will be increased. Pointing the stick in a fire or by rubbing it on a stone or by a combination of both may give it a more effective shape and thereby increase the work it will enable a man to do. The substitution of a *khurpi* and *pharua* instead of the pointed stick will further increase the work the man can do. The addition of a small pair of bullocks and a small plough will increase both the amount and the kind of work possible. The use of a bigger pair of bullocks and better implements will still further increase both the amount and the kinds of work possible. The illustration can be carried further but perhaps this will illustrate the point. The production per worker and therefore his income may vary from place to place with soil and other conditions, but, under any one set of conditions, the possible production per worker will vary with the extent to which he is able to use power and machinery (including "implements" and "tools") in his work. This may be limited by lack of capital, by lack of land, by lack of knowledge or ability, by lack of initiative or by any of a number of other factors or by a combination of many factors, but such a limitation does not invalidate the principle. Therefore we can say that the standard of living of a country is dependent on the extent to which power, tools and machines are utilised. The greater the use of these things, the greater the production per worker and the total production. When production exceeds the necessities, luxuries become possible.

Production per acre may or may not be related to a high standard of living. The essential ingredient in a high standard of living is the availability of those things which

give satisfaction to the consumer. This includes leisure. Increasing the production per acre by increasing the number of persons employed per year and having no other occupation, will raise the standard of living only if the increased production is greater proportionately than the increased labour, in terms of workers employed. An individual worker may increase his production of food or other product by a change of work which enables him to work more hours. This will increase the production of goods but decrease the leisure he previously enjoyed. Whether it increases his standard of living will depend on whether he gets more satisfaction from increased food, for instance, or from more leisure. If there are persons in the community who are unemployed or only partially employed, the use of their labour to increase production per acre will increase the total production and so the average production per person supported by the group and so result in a proportionate increase in the material standard of living, again with a decrease in the leisure enjoyed by the group. Increasing the production per acre by the employment of more people throughout the year on the same area will increase the number of people who can live on the same area. It will improve or lower materially the standard of living according to whether the increased production is proportionately more or less than the increase in number of persons employed. Even in cases where an increase in production per acre by the use of increased labour results in a net increase of production per worker, the question will still remain whether the additional labour might not gain greater satisfaction from being employed in other ways, for instance in cultivating more land or in industrial work. (The census of India states that approximately half of the "culturable area" is still uncultivated). In any case, the improvment in the standard of living depends on the increase of the average production per person supported by the group of workers, which usually means an increase in the production per worker employed, and not directly on the production per acre

In considering future agricultural policy, we must recognise certain facts. It seems evident that the day is past when men, either in villages or in cities, will remain satisfied

with only food and clothing or with an insufficiency of either. They now demand, and in the future will increasingly demand, the good things of life represented by industrial products, education for their children, better homes, travel, literature and radio, reasonable leisure and other things associated with comfortable living. Simple living and high thinking may be a desirable ideal but people are likely to prefer a bit more comfort and to feel that it can be combined with as much or more high thinking. We should no longer expect that a large part of the population will be content to engage in agriculture, producing hardly more than a bare subsistence for themselves, and being willing to sell their small surplus for barely more than the cost of hauling it to market. At present, industrial wages provide a higher standard of living in many respects than do the wages earned by the agricultural labourer The standard of living resulting from industrial wages is comparable to that of the independent cultivator or the petty zamindar and in addition offers the amenities of living in a city or town. It is true that the agricultural labourer has certain perquisites in the villages which give a security which industrial work does not give at present. It is also true that conditions of industrial employment are being improved and that the position of the agricultural labourer is deteriorating in the village with the progressive breaking down of the old subsistence form of village organisation. It is likely that there will be a continuing transfer of workers from agriculture to industry, particularly the landless labourers and probably the cultivators having small uneconomic areas. There is no question but that the present number of labourers in the village is more than is required at most seasons and that with modern farm equipment a considerably smaller number of workers will be sufficient to carry on the same or a greater amount of work. In my view, this transfer of workers from agriculture to industry is a good thing since it will enable an increase in total production to take place resulting in a rise in the standard of living for both rural and urban populations. Some think it bad. Whether good or bad, it is, I believe, inevitable. The sooner we realise that it is taking place and do what we can to direct and guide it in ways that will

result in the minimum of suffering and the maximum of benefit, the better it will be for all concerned. It seems inevitable that there will be a decreasing proportion of the population engaged in agriculture and that this reduced proportion of the population will be called upon to produce a larger volume of agricultural produce.

Some have suggested that cottage industries are a means of preventing the necessity of a shifting of the population from agricultural to industrial life. The history of other peoples does not indicate that this is any permanent solution. All the evidence is that progress in improving the standard of living is the result of the division of labour, of those with special aptitudes and abilities devoting themselves to the things they do best, and of the use of the best equipment available. The worker in cottage industry fitted in well when the village was a self-contained unit, and had no connection for either buying or selling with the outside world. That time is gone. If he produces at all efficiently, he makes far more of his product than can be consumed in his village. He has to do his own purchasing of material, the manufacturing and the selling as a finished product. Securing the material and marketing the product may take a very large part of the total time. The cottage worker may be supplied with material and the product taken by a dealer or even by a co-operative society, but still the home does not provide good working conditions. The amount which can be earned is invariably so small that excessively long hours must be spent and there is always the temptation to have women and children join in the work to the detriment of the health and education of the children and to the neglect of the home-making function of the mother. The cottage worker has neither the capital nor the skill to use the most efficient means of production and so his earnings are limited. These remarks apply to the making of articles in the home for sale outside. Cottage industries in the sense of the preparing of things in the home for the use of the family are in a different category and are not subject to the above remarks. It has been the experience in Western countries that low earnings, depressed labour and bad conditions of work have invariably been associated with manufacture in the homes. Bad as

conditions have been in some cases in factories, they have rarely been better in cottage industries where things were made in the home for sale in the market. There does not seem to be any reason why this experience should not be valid for India.

On the other hand, there are many reasons why it is not necessary in India to repeat the early history of factory labour during the Industrial Revolution in Europe. Then power was available only from water or later from large steam installations. With the perfection of the modern internal combustion engine and more recently the wide-spread use of electricity, especially the covering of the country-side with a grid system which makes electricity available even in small towns at low cost, small but highly efficient factories become possible which make possible the combination of efficient production methods with controlled and reasonably good conditions of work and residence in a rural area. While it seems inevitable that a considerable part of the population should be shifted from agricultural work to industrial production, it does not follow that the population must be shifted from rural areas to large industrial centres. If the process is allowed to go on unheeded and uncontrolled, this shift to large centres of population with its attendant evils is likely to take place Small but efficient rural industries are particularly practicable in the case of those industries which fabricate industrial products from agriculturally produced raw materials.

If our assumption is right that a smaller proportion of the population must provide not only the present volume but an increased volume of agricultural products in order to produce a higher standard of living, more efficient production is necessary. More efficient production can only result from the use of more power per worker, better implements used, the cultivation of more land per worker and from better crops and animals.

Contrary to the common belief in India, the area cultivated per worker is a function of the implements and power available rather than of the inheritance laws. It is undoubtedly true that the fragmentation of holdings is a bad thing.

Very small fields and scattered fields are a disadvantage. However, with present implements and power, the system of scattered holdings has advantages which should not be overlooked and which should be understood by those who would change the system. The smallness of a field becomes a disadvantage only when the field does not provide work for a full work period, usually half a day. If workers have to transfer from one field to a distant one in the middle of a work period, time is lost thereby. The advantage of scattered holdings is that usually the village is located at the most fertile part of the area. The land near the village site may have been originally more fertile or the difference in fertility may be due to the deterioration of the outlying area from continual cropping without adequate manuring along with the building up of the nearby fields by manuring. In any case, the fields are not of equal fertility and it is an advantage to the cultivator to have at least some of his land near to his dwelling and some in the more fertile area.

Any complete consolidation of holding probably will result in an unequal distribution of the more fertile land; and if living in a compact village persists, it will result in some having all their fields close by, while some will have all their fields far away. As long as the old indigenous implements and methods are used, the benefit from consolidation of holdings may be much less than has been thought when the sum of advantages and disadvantages are considered. This is not meant as an argument against consolidation of holdings but only as pointing out some considerations commonly overlooked.

The statement that the area cultivated per worker is a function of the implements and power available may be challenged. Careful investigation seems to indicate that in any given area the area cultivated per full time cultivator is approximately the area which can be cultivated by one plough and one pair of bullocks, under the soil, climate and crop rotation conditions prevailing in that area. There are many things which tend to obscure this. In most villages there are a few who have large areas and employ two or more ploughmen. Also there are a certain number who have inheritable rights to some land, often only a very small area

which they cultivate, but who are not cultivators by profession but carters, *ekka* drivers, *telis*, *darzis*, *dhobis*, or *kumhars*, or who get their income mainly from sources other than agriculture. The average area calculated by dividing the total cultivated area of India or of a province by the number having inheritable cultivating rights in India or in the province is likely to give a figure having no relation to the area actually cultivated by each full time farmer. It would be equally rational to try to arrive at the wage enjoyed by most of the workers in a factory which has a manager drawing Rs. 1,000 per month, two clerks on Rs. 50 and 50 workmen averaging Re. 1 per day or Rs. 30 per month by adding the total wage bill and dividing it by the number of workers. Rs. $1,000 + (2 \times 50) + (50 \quad 30) \div 53 =$ Rs. 49, the average monthly wage. This approximates the wage earned by 2 of the 53 people employed but is hardly representative of the earnings of the manager or of the workers. Unfortunately, the census figures seem to give no information on the proportion of holdings of different sizes. It seems likely that many of the figures commonly given of the "average" size of holding is likely to be about as near the actual area commonly cultivated as the case cited above; that is, the "average size of holding" does not represent the area cultivated by most of the full time cultivators. The area cultivated per plough varies widely with differences in soil and climate, different crops and different rotation and cropping procedures. So far as I have been able to determine by questioning without definite statistical surveys, it seems to be pretty close to the area which can be controlled with one plough, if we exclude the areas cultivated by part time cultivators. Those who have more land, sub-let land or have two ploughs and hire ploughmen. Those who have less, combine their holdings with land taken on rent from others.

More land per cultivator can be secured in one or more of three ways:

(1) Workers may be transferred from agriculture to industry. At present, about 75% of the population is engaged in agriculture (the rural population is a larger percentage of the whole but not all are in agriculture). The percentage of the population which should remain in agricul-

ture cannot be stated definitely at present. Some authorities suggest that we should aim at 50%. This would allow for an increase of about 50% in the area available per cultivator remaining in agriculture. There is some indication that in Western countries the percentage of the population remaining in agriculture is tending to become stabilised at about 25%. This would make an area about three times the present area available per cultivator. Probably the practicable change lies between these extremes. The smaller the proportion of the population which can adequately feed the whole population and produce other necessary agricultural products, the higher the standard of living possible to the whole group becomes, assuming of course that the remaining part of the population is adequately employed in industry.

(2) Additional land can be brought under cultivation. The census figures show that about half the "culturable" area is now under cultivation. If the whole of this were brought under cultivation with no other change, it would obviously double the area available per cultivator. How far this is practicable is uncertain. No explanation is given in the census figures as to why the area is not fully cultivated. Doubtless there are various reasons, the main one being that the production secured with present methods and implements would not support a cultivator—that is, cultivation would be "unprofitable." Much if not all of it will be profitable if better implements and methods—and perhaps crops—are introduced. With no change in population, it appears that the increase in area which is practicable per worker will lie between three and six times the area now cultivated, depending on the extent to which population shifts from agriculture to industry and on the extent to which "culturable waste" can be brought under cultivation. With the present population, this means that something like 30 acres per cultivator is the figure which may be considered ultimately attainable.

(3) Additional area per cultivator can be attained by a reduction in population. At present the population is still increasing and a reduction is hardly likely to take place, at least nothing at present indicates the likelihood of it. Rather some further increase seems likely which would tend to reduce the area available per cultivator.

Earlier the statement was made that there was no necessary relation between the standard of living and the production per acre, that the standard of living depended directly on the production per worker. In the past, population has tended to crowd into those areas which were naturally fertile and where the production per acre was high. The implements tended to develop, and the methods to be chosen, to fit conditions in these areas. It has been generally true that poverty has been directly in proportion to production per acre, the most abject poverty being found in those areas having the highest production per acre because the population tended to crowd in there and to use hand implements and excessive amounts of human labour on small areas. Much if not most of the cultivated area in India has been farmed for generations by methods which returned to the soil the minimum fertility possible in manure. The result has been that the organic matter in the soil has been reduced to the lowest amount possible and with it the yield per acre has gone down. This has been largely the direct result of the type of implements used which make necessary the removal of all grass and weeds or of nearly all, before ploughing is possible, does not allow green manuring and requires the very thorough removal of all crop residues either before or during the preparation of the seed bed. Some have felt and taught that the lack of organic matter in the soil is due primarily to the burning of manure for fuel. While this undoubtedly contributes to the shortage and while it is a practice to be condemned and abandoned, and while the careful use and preservation of all the manure is highly desirable, in my opinion such conservation and use will not completely solve the problem. "Manure" as the term is now used in India consists almost entirely of the dropping of animals. It is important that these be preserved. In addition, to get the best results in increasing the organic matter content of the soil, it will be necessary to conserve crop residues, volunteer growth such as grass and weeds and to utilise green manuring, none of which are satisfactorily done by the implements in common use. Mainly through the increase in organic matter in the soil which can be made possible by the use of better implements and partly by the better control of soil moisture which better

implements make possible, the average production per acre of most field crops can be at least doubled. This will not be true of the most fertile lands near the village sites. On the other hand, land not now productive or giving very poor yields can be increased in fertility to give yields several times those now secured so that the *average* yield can be increased by at least 100%; that is, the present total yield can be doubled. Where this is possible, as it is with the use of better implements, without increasing the amount of human labour required or with better use of available human labour so that production per person supported is increased it will result in a raising of the standard of living. Some of the methods and appliances by which this can be accomplished may be discussed later in this paper.

It is recognised that the introduction of better crops and better animals, the control of crop pests and disease, better cropping practices and rotations also contribute to increasing the total production per cultivator. However, these aspects of the subject are outside the scope of this paper and will only be mentioned to indicate that failure to discuss them in detail does not mean any failure to recognise their importance. Certainly any permanent agricultural policy for India must take advantage of all the gains possible from these improvements also. Failure to discuss them in detail in this paper is due to the limitations of the subject, not to a lack of recognition of the contribution they can make to raising the standard of living of the Indian cultivator.

The Application of Engineering to Indian Agriculture

Engineering and its allied sciences of chemistry and physics have revolutionized industrial production in the last two centuries. The application of mechanical power and the use of machines by which mechanical and animal power are applied to the production and fabrication of materials have made available to the ordinary person materials, facilities and services which only two or three centuries ago were not available even to kings and emperors. To those of slightly higher economic status, facilities and material things which could not be imagined by our forefathers as possible have

become commonplace. This process has been applied more to industrial production than to agriculture in the last 400 years. The relatively small extent to which it has been applied to agriculture has made possible a trebling of the population of the world. This increase in population has been accompanied by a rising standard both in quality and quantity of food and clothing throughout the world, including India. In western countries, while still far from complete, the application of engineering to agricultural production has proceeded far. In India, it has barely begun. It seems likely, on the basis of the experience of other countries, that the application of engineering to Indian agriculture and the possibilities of changing our agricultural practices resulting from such application offer greater possibilities of increasing agricultural production in India than any other single line of improvement now open to us.

What is meant by the application of engineering to Indian agriculture? Does it mean the substitution for the animal and human power now in use, of large engine driven implements, dependent on imported fuel?

Engineering may be defined as the art and science by which the mechanical properties of matter are made useful to man in structures and machines. This includes the control of power as well as matter. While the mechanisation of Indian agriculture would be *an* application of engineering to Indian agriculture, it is by no means the only or necessarily the most important phase. There is a place for some large power machines in India for agricultural uses. Wherever they fit into the needs, there should be no prejudice against their use. The main place, however, should be given to improving the implements and appliances which can be used by farmers now doing cultivation. The development of a better *khurpi* or of a better yoke for bullocks would equally be an application of engineering knowledge and practice to Indian agriculture. Perhaps the following list of activities of the agricultural engineer will give an idea of how engineering knowledge and skill needs to be applied to Indian agriculture.

Research should be directed towards developing implements which can be utilised on farms approximating these

now available to the larger cultivators in each area. Some margin of capacity may be desirable; but in general the implements should not require abnormally large farms for their success.

Secondly, the power for working the implement is as important as the implement. Special attention should be given to reducing the power required by attention to design and construction factors. A slight increase in cost accompanied by a distinct gain in efficiency may be well worthwhile. The question of improving the bullocks hardly comes into the scope of this paper. I would however, in general, design implements for use by the better 50% of the animals commonly in use in a region, not for the smallest nor for animals larger than those commonly used Due attention should be given to improvement in yoking. As much as 25% increase in work done may be secured in some cases by simply changing the yokes for a better type. Some efw operations may justify the use of two pairs of oxen working together but, where possible, implements should be capable of operation with one pair. Care should be taken, *especially on Government and demonstration farms*, not to work implements with animals bigger than necessary. The use of big heavy bullocks with Meston type ploughs on Government farms has spread the impression that such bullocks are necessary and where it is realised that smaller bullocks are strong enough, it has lowered the prestige of the farm in the eyes of the cultivator.

The following is a suggestive list of investigations which need to be carried out, keeping in mind the principles laid down above. It is not meant that this list is exhaustive or complete but only suggestive.

1. The relation of improved implements to soil fertility, particularly in relation to dry-weather ploughing and to green manuring. A properly worked out and applied cropping system including regular manuring with all available types of organic manure, including green manure, will in a few years double the average yield per acre of most areas in India, but this can only be accomplished if improved ploughs come into general use.

2. A full investigation of the problems of fodder production and storage under village conditions, including particularly the possibility of making silage. It should not simply be assumed that nothing can be done. Investigations should be carried out to determine the minimum practicable size of silo, the minimum herd for which a silo is practicable, the conditions to be met to make such a silo practicable, how nearly the average cultivator of each typical area comes to having the required conditions and, possibly, whether any do. There is at present a shortage of fodder. This can be met partly or wholly by a reduction in the number of cattle made possible by the use of more efficient implements, by increased production of fodder on cultivated fields and by better preservation and utilisation of fodder produced.

3. The problem of harvesting, both of *kharif* and of *rabi* crops. Possibly next to weeding and interculture, the harvest is the operation which makes the biggest demand for seasonal labour. It was improvement in the methods and equipment for harvesting which really began the agricultural revolution in western countries. While it is not always realised, present methods of hand harvesting are not only wasteful of human labour but often result in substantial loss of grain by shattering.

4. Improved methods of threshing, winnowing and grain dressing should give a substantial increase in the income of the cultivator. It is commonly said that 10% of the grain grown never gets into the store. A substantial part of the loss occurs on the threshing floor where insects, birds, rodents, rain, fire, all take their toll. Any development that will reduce the time that grain lies on the threshing floor will reduce this loss. This is also tied up with the problem of dry weather ploughing to some extent. Any development which reduces the time oxen must spend on threshing will increase the time available for other operations.

5. There is need for a device for lifting water efficiently for small lifts. Many canals run just below the surface so the water has to be lifted for use. Many small and medium sized streams occur where it is not practicable to make canals but where the water could be used with a lift of five

feet or less. In some cases *jhils* and swamps provide a considerable supply of water. No device so far has come into general use to compete with the few *deshi* devices. It appears likely that a study of the fundamental hydraulic and mechanical principles would yield a bullock operated device for these conditions which would do for the farmer what the Persian wheel has done for those having higher lifts.

6. The present metal Persian wheel is a great improvement on the old wooden one with grass ropes and clay pots. For shallow depths, it works fairly well but in deeper wells wear on the chain is very severe. There is need for a better chain for carrying the buckets and possibly for better bearings. There is need for the investigation of the possibility of better gearing, arranged for separation from the chain wheel so that it can be used for other purposes.

7. Very little attention has so far been paid to the possibility of using bullock power for some of the power needs requiring rotary power, other than the Persian wheel. While it is true that generally a pair of bullocks cannot be expected to develop more than about one horsepower, that amount of power can be usefully applied to a number of jobs, provided that it is used by efficient machines. If the bullock gearing is separate and easily attached, the cost may be kept within the reach of the better-off cultivators and contribute materially to their welfare.

8. A rich field for investigation lies in the whole subject of soil and water conservation. Agriculturists generally seem to assume that only level land is culturable. A great deal of labour and trouble is expended in levelling all fields into bench terraces, whether they are to be irrigated or not. Fields are quite generally bunded to impound the rainfall and no provision is made for drainage or run-off. The bunded fields are rarely able to hold the heavier rainfalls, so breaks occur. These are caused often with moderate rainfalls by rat and other rodent burrows in the banks. The impounded water often causes severe erosion when breaks occur. Gullies once started are, with present practices, generally uncontrollable. Not only in the hills and on high river banks but all over the plains enormous losses of top soil occur. The soil being hard and compact when the first rainsfall at the

beginning of the rainy season, the first rain often carries off any manure, crop residue or other organic matter remaining in the fields. Some of this loss can be controlled by engineering structures such as soil saving dams, *pakka* or grassed spillways, terraces. Either in combination with these means or alone, much can be done with cultural practices with suitable implements. Examples are loosening the soil by dry weather ploughing and, possibly, basin listing, and retaining on the surface or working into the surface of crop residues or other organic matter to help absorption and retention of water. Much can be done by the use of cover crops on all fields not carrying *kharif* crops and by early planting of *kharif* crops so the fields are covered early in the season by the crop. The possibility of using a low growing leafy legume interplanted in fodder crops after one or two intercultures to serve as a cover crop needs to be investigated. This investigation needs to be carried on jointly by agricultural engineers and crops men.

9. Transportation of crops from field to farmstead and from farm to market in head-loads is one of the very large wastes of agricultural labour. The amount of useful work which a man or woman can do this way in a day is very small. There is need for development of suitable carts for the handling of farm produce both on the farm and for transport to market. This will involve consideration of farm roads and of village roads. What should be the load capacity of the cart in terms of weight and in terms of volume? What materials are most economical for constructing the cart? What is the best design of the cart as a whole and of individual parts, such as wheels?

10. What is the need and what is the possibility of farm fencing in India. Is it necessary or desirable to fence individual plots or is it possible to fence whole village areas? What changes if any will be needed in present systems of cropping or of land tenure before fencing can be satisfactorily adopted as a general practice? What materials will give the best combination of desirable characteristics, economical first cost and low maintenance?

11. While any extensive rebuilding of village homes and other buildings may have to wait for some rise in the

standard of income, it is not too early to begin survey studies of the building needs of the cultivators. What is the extent and cost of cultivators' residences, what improvements are needed, which ones can be made at costs within the means of the cultivators, what are the improvements of which the people now feel a need, what improvements can be easily introduced with propaganda and demonstration, how many cattle are kept and what provision if any is made for housing them, what provision is needed for storage of fodder and feed, can such storage be combined satisfactorily with storage for other grain and seeds? These are some of the questions which should be investigated and the answers put on record for the different areas With such information on record, experimentation and propaganda for better farm buildings should be started wherever conditions make this possible. This is as yet practically an untouched field in India for which agricultural engineers should take at least part of the responsibility.

12. Agricultural engineers should take greater interest in developing equipment for the dairy industry, particularly for the use of the *gwala* and small dairyman. For large scale operations, probably the need is well met by the introduction of standard types of equipment from abroad, though manufacture in India may be encouraged. However, in co-operation with dairy experts, there is need for the development of equipment of a simple type for *ghee* making and refining in villages, for equipment for the transporting of milk and milk products from the farm to dairy and for the distribution of milk to consumers, for cheap but efficient barn equipment, mangers, animal ties and many other things, to the development of which the agricultural engineer could make valuable contributions.

13. The making available of new equipment to the cultivator is as important as the designing and manufacture of it. Many smaller implements are suitable for individual ownership. Larger machines, more complicated machines requiring more training or skill for operation or requiring repairs outside the skill and facilities of the village blacksmith will, in the beginning at least, have to be made

available otherwise. Co-operative ownership is often proposed without any clear definition of how it is to be managed. Co-operation of a few individuals as partners is almost certain to fail completely. Co-operative society ownership and giving on hire for operation by the cultivators may be satisfactory in the case of the simpler things otherwise suitable for individual ownership but too costly for the use made of the implements, particularly if adequate provision is made for repairs. It seems unlikely that the required provision for repairs will be made in the case of relatively small local societies but experimenting by those who think it will work may be encouraged. The most favourable conditions for such experiments will be localities where agricultural engineers can give help and advice to the local society on the selection, purchase and maintenance of the implements. If larger power-driven devices such as threshing machines should be introduced, best results will come from their being owned and operated by individual contractors who are paid on the basis of work accomplished, but co-operative society operation may be successful provided a sufficiently well trained operator is hired and paid a suitable wage. This seems unlikely to happen as the society members are almost certain to be tempted to try a cheaper and less skilled operator to the harm of the apparatus and with resulting prejudice against such improved equipment generally. In any case, agricultural engineers should study and, where possible, experiment with solutions to these problems.

14. The problem of merchandising improved implements should also have attention. Improved implements have been most successfully brought into wide and common use in India where they have been merchandised by private enterprise. Government sales through official channels have to overcome the natural suspicion of the cultivator and the inertia of the paid agent whose income does not depend on results secured. This needs investigation and demonstration or disproval and a reorientation of policy accordingly. The attempt to distribute improved implements cheaply by government agency tends to strangle private enterprise, partly by setting prices below that level at which reasonable returns can

be made from the business and partly by excessive control over types and models allowed to be distributed through government channels or with Agricultural Department approval. Every opportunity should be taken to experiment with alternatives to government merchandising of implements and machinery.

At the beginning of this paper, mention was made of the need for objectives. Perhaps we are now ready to restate in more detail the objectives which we should have in mind in planning for the applications of engineering knowledge to agriculture. The following list is at least a partial statement of objectives which should be kept in mind. It is not necessarily exhaustive or complete. The items are not in any order of relative importance. As all are important and should be pursued together, the question of relative importance does not arise.

(1) The increase of yield per acre. The use of better appliances and implements worked by bullocks will make possible the use of better soil management practices, such as green manuring, dry weather ploughing, and the turning under of crop residues, which will easily double the yield per acre of the ordinary food and fodder crops with no increase in human labour required, but in fact with a reduction.

(2) The bringing into cultivation of land now unproductive. Much of the uncultivated land now produces only a little indifferent grazing. Much of it cannot be cultivated with the *deshi* plough but can be made productive by the use of better bullock-drawn implements. A small fraction of the increased yield will provide more cattle fodder than the grazing now secured.

(3) The better utilisation of human labour. We now require the services of men, women and children at certain seasons of the year in order to cope with the work. We cannot expect to have a high standard of education for children who have to spend long hours in the fields. We cannot hope to have the best type of homes for cultivators whose women folk have to spend long hours in the fields. Much or probably nearly all of the work now done by women and children, aside from herding cattle, can be easily done by

the use of better implements, making it possible for the men to do the work now done by men, women and children.

(4) The release of labour from agriculture for employment in industry. We have spoken of the effect of such a transfer of labour on the standard of living but not of how it can be accomplished. At certain seasons there is a shortage of labour in the villages, at others widespread unemployment. An unemployed man is unproductive, hence a reducer of the standard of living rather than a raiser of it. Better implements will make possible a better distribution of the work throughout the year, reducing the seasonal demands for casual labour and making it possible for a smaller number employed throughout the year to do the work now requiring a much larger number at certain seasons only. Before there can be any really large scale development of industry, there must be a release of men from agriculture. Or, what amounts to the same thing, if men leave agriculture to enter industrial employment, other means of doing the work previously done by them must be found.

(5) The making possible of some leisure for those employed in agriculture. While it is true that there are periods of comparative leisure now, it is also true that the work of the farmer, when done with the old tools and the old methods, requires a tremendous amount of hard manual labour, drudgery in fact, for a very small return. Most people like to work some if they can choose the work and stop when they have had enough. While I subscribe fully to the theory of the dignity of labour, it still seems a worthy objective to reduce human toil, to make it possible for a man to earn his bread in the easiest way possible. It does not seem that it necessarily follows that a man will deteriorate mentally, morally or physically if he does not have to labour to the limit of his strength. Poor division of labour, resulting in unemployment for some, while others have to toil day and night is bad. However, the division of both work and produce is a matter of social organisation. Surely the intelligence which had made possible the conquest of nature and the tremendous possibilities of increasing production which are opening before us, should be capable of devising a

social organisation which will enable us to divide both work and production in the interests of all.

If improved implements can do such great things for Indian agriculture, why has progress in introducing them been so slow? Why have they not taken hold more universally and become more commonly used in the village? Two alleged reasons have been most commonly offered, both of very minor importance. Failure to understand the fallacy of these excuses has hampered the introduction of implements very badly. The most commonly given reason is the poverty of the villagers. The cultivator has found this the easiest defence with which to avoid accepting something which for other reasons he does not wish to take. It is easier and politer to say that we have no money than to say that we do not believe the claims made for an implement. No one wants to sell to him who has no money with which to pay. This excuse is very generally accepted and believed to be a reason why improved implements are not more widely used. There is no doubt whatever that the average standard of living of the cultivators is very low and that many of them are very poor. Very few of them can afford to experiment but many can purchase a proven implement. It is not possible to provide improved implements for everyone at once, for instance improved ploughs for the replacement of the 5,000,000 wooden ploughs now in use in the United Provinces alone It is always the more progressive—and they are usually the more prosperous—in any community who first adopt any improvement or innovation. Often the same man who pleads poverty as an excuse for not buying a plough costing Rs. 5 to Rs. 10, will find 5 to 10 times that amount for a wedding or a pilgrimage. Many of them do find Rs 20 to Rs. 40 for the *hire* of a sugar cane crusher for a single season The sugar cane crusher costing Rs. 100 or more has entirely displaced the old stone cane crushers. In many parts of the country, chaff cutters costing Rs. 25 and above are replacing the *gandasa* costing a few annas. If poverty is the reason ploughs are not bought more freely, is it any less operative in preventing the purchase of cane crushers and chaff cutters?

The charge of excessive conservatism is a similar case. It is unfair and unjust to make this charge without due knowledge. Undoubtedly there are cultivators who are excessively conservative. Again it is true that the cultivator cannot afford to experiment. He must know before investing his money that a new implement or tool will work well under his conditions. When he has this assurance, by evidence which he trusts, not simply the word of someone he does not know, he adopts things with reasonable quickness. The quickness with which the modern iron roller sugar cane crushers displaced the older crushers in just a few decades is evidence of this. The widespread and increasing use of chaff cutters is another instance. The use of hurricane lanterns, bicycles, matches, has become common where improved ploughs are still nearly unknown, or at least far less common. It does not seem likely that conservatism is a force which would deter people from using better agricultural implements, while not deterring them from these other things. It does not seem to keep them from using and appreciating the motor bus (lorry) or the train. It seems far more likely that the real reason is that the improved or so-called improved implements which have not come into common use do not fit into the needs of the cultivator in the same way as the others have. Agricultural experts should not be so sure of their being right that they cannot see the possibility of defects in their recommendations. They should not justify their failure to meet the needs of the cultivator by charging him with being excessively conservative and unwilling to adopt new things.

It seems certain that while poverty may deter some of the poorest and conservatism may affect some, the failings and shortcomings of the implements offered has been a much greater force. There is not the least doubt that improved implements can do everything the wooden plough can do and much that it cannot do. The wooden plough is obsolete and should be discarded completely, not because it is *deshi* but because it is inefficient. It is inefficient because it tries to combine in one implement without attachments to many functions. Among implements as among human workers, efficiency is promoted by division of labour. To improve on the efficiency of the wooden plough, we will have to provide

specialised implements, either as separate implements or as attachments for one implement, each of which does one job well. When implements fit the needs of the cultivator as he sees them—and the Indian cultivator in general is a shrewd, intelligent man even if he is not literate—we will find that he is neither so conservative nor so poor that he will refuse to use them. However, he rightly insists on using his own judgment as to what fits his needs.

Aside from the question of suitability of the implements available, the cultivator does face certain difficulties which often keep him from doing things he would like to do. The general outlook in India is fatalistic. "Jo hoga, so hoga" is a common attitude: *karma* and *kismat* are strongly believed in. There is widespread doubt whether any real improvement in the existing conditions is possible. This doubt is often shared by students and teachers as well as by villagers. The one essential ingredient necessary for progress, the belief that progress is possible, is often lacking. This is different from conservatism, a personal unwillingness to try anything new.

The whole social organisation of the village and the caste system is designed to secure stability and to discourage change. Family, caste and village are likely to be suspicious of the one who acts differently from the others. Before taking any important step towards changing the implements, crops, or practices he follows, it is often necessary for the cultivator to get the approval of his family, the *biradari*, and the zamindar. The zamindar is often a deterrent force. Many are indifferent to their tenants and, while some actively encourage the tenants to improve their methods, many also look with disfavour on any change as likely in some way to affect their position and many tend to take in one way or another any benefit accruing from any change in implements, crops or practices. No one of these factors will necessarily be present at every place, but cumulatively they do hinder the introduction of better implements and the practices they make possible.

Ignorance is a real factor in many cases. Improved implements have been sold largely through the Agricultural

Department. While the Department has undoubtedly made a great effort to inform the villagers, still the number of villages is very large and the staff small and it takes a long time to get round. The general absence of newspapers and magazines and the lack of advertising of the new or improved implements is also a handicap as compared with western countries. Many cultivators simply do not know what implements are available and what they can be expected to do.

Agricultural experts generally have failed to understand or to appreciate the value of the "jajmani haq" system in the villages under which indigenous implements and tools are made and repaired. Not understanding or appreciating it, they have not used it, in fact have perhaps unknowingly tried to displace it. Under this system, the cultivator pays the village blacksmith or carpenter an annual fee, usually in two instalments at the harvest times, in return for which the blacksmith or carpenter maintains a specified set of implements. This includes repairs, adjustments and the making of new things when necessary, usually from material which the cultivator furnishes. The cultivator has no metal or wood-working tools with which to make or repair implements and no experience in using them. He is dependent on the blacksmith or carpenter for all but the simplest repairs or adjustment to the implements he uses Suppose a demonstrator comes to a village and shows the working of a new plough. The cultivator likes the implement but it is strange to him and he asks about repairs, whether his blacksmith or carpenter can do the necessary repairs. The demonstrator assures him that it is iron, that the only repair needed is occasional changing of the share. (The policy has been to supply cast iron shares of the self-sharpening type and to recommend that they be discarded when worn and replaced with new ones.) The question of whether the blacksmith can repair it or not is unimportant as it will not need his service. The blacksmith is likely to be at the demonstration and to hear this. The cultivator from his experience is not so sure so he asks the blacksmith whether he can do the necessary work or not. If the cultivator is influential, the blacksmith may not dare say that he *will not* for there are ways of compelling him to do what is desired. If what the demons-

trator says is true, he sees an end to his annual payment from the cultivator who takes to the new plough. He does not wish to encourage something which will destroy his livelihood. The safe thing to say is that he *can not*, which he says. The cultivator knows that, in spite of the demonstrator's assurances, sooner or later he will need the help of the blacksmith so he too plays safe and leaves the new plough alone, though he may want it badly.

The continuance of the annual fee system should be actively encouraged. It has valuable features. The cultivator knows in advance what he will have to pay for repairs and the blacksmith knows that he will have a stable income for at least part of his needs. There is security in it for both. There is no reason why the improved plough should not be substituted for the wooden plough in the system. It may be true that the new implements will require *less* service than the older ones. It may be possible to substitute a different set of things and even to vary the annual payment by agreement between the cultivator and the mechanic without destroying the system.

This system may offer a means of caring for the repairs of implements owned jointly or through a co-operative society. If the society directly, or through its members personal relations with the blacksmith, makes arrangements on this basis of an annual payment for the repair of such things as grain drills and other fairly large and expensive implements, it may be possible for the Society to own fairly complicated and expensive implements and still allow them to be operated by individual members of the society or even to give them on hire to non-members if that is desired. Having the repairs already paid for will encourage operators to have them done when needed. It will remove the fear that a large and expensive repair may become necessary while the implement is in the hand of a particular user, even though it is the result of wear over a considerable period and not the fault of the current user.

Another real difficulty is that the cultivator has to carry on throughout the year. We have offered him implements piecemeal, each designed to do a part of the work

but we have not organised them into a set of implements and tools which could effectively replace the implements he has been using. Too often we have made a fetish of cheapness and simplicity, particularly cheapness, to the point where the tools offered are ineffective. We see the obvious shortcomings of the wooden plough, its failure to invert the soil, its shallow working, the necessity of using it repeatedly to work the soil fully. We reason "Western agriculture is the finest in the world; Western agriculture uses soil-inverting ploughs; therefore—" so we proceed to introduce soil-inverting ploughs. We find that the soil-inverting ploughs used in the west are too heavy for the average cultivator's bullocks, so we design new ones of smaller size, taking size as the only factor, without investigating the effect of the yoke used or the possibility of recommending the ploughs first only to the farmers having the larger oxen. We get a small plough which the cultivators' bullocks can use and which is cheap, but in the process we have modified it so that it will not satisfactorily do the job for which a soil-inverting plough is badly needed, the burying of green manure, weeds, trash, and crop residues. We go ahead and introduce it with these defects and without considering that it is not suitable for use throughout the year. The cultivator discovers that he cannot use it for all the things for which he formerly used the wooden plough, so we tell him to go ahead and use the wooden plough for the other things. Having the wooden plough, he is tempted to use it for everything if there is any small defect in the improved plough. When an improved implement is introduced, its uses as well as its limitations should be clearly understood. A complete substitution, that is the provision of implements which will work throughout the year, doing all the operations necessary instead of only a few, will also be more valuable to the cultivator.

Another discouraging practice, something which has made the cultivator fear to try the new ploughs, is the practice of using the very small ploughs, designed for village oxen weighing 900 pounds to the pair or less, behind big oxen on Government Demonstration farms and even on private farms, where the oxen weigh 1,800 to 2,000 pounds per pair. We *tell*

the cultivator that his oxen can pull the small ploughs but we *show* him that he needs big bullocks and he believes his eyes rather than his ears. Big bullocks are certainly an advantage if used with implements large enough to utilise their strength. It is certainly desirable to teach the cultivator to have bigger and better bullocks. At the same time, the ordinary size holding cannot at present afford to feed a big pair of bullocks nor does it have work for the big implements to go with them. The smaller implements, if combined into effective sets and used with suitable bullocks, are a useful improvement on the present implements and should be introduced, even though eventually they should be displaced by bigger and more effective implements. Introduction will be hastened by using them on demonstration farms, Government or private, with bullocks for which they are suited. This means bullocks weighing 1,000 to 1,200 lbs. per pair, bullocks about the size of the better 25% of the ordinary village bullocks in the central U.P. It is desirable that the demonstration farms use some bigger bullocks and bigger implements. It is highly *undesirable* that the small implements be used with big bullocks and it is undesirable that the smaller implements be neglected altogether. It follows, therefore, that a demonstration farm should have and use both sizes of implements and of bullocks.

Indian agriculture is in need of improvement, in order to provide adequately the food, fodder, fibre, and other crops needed by the population. A major way in which this improvement can be effected is by the application of engineering knowledge and skill to agricultural problems. These engineering problems in agriculture are themselves complex and involve not only engineering but a knowledge of other agricultural practices. As is true of other sciences and arts, the knowledge of engineering is not entirely confined to those who have been trained in it. However, it is true that best results in investigating a chemical problem are likely to be secured by a trained chemist and in the investigation of a plant breeding or any other scientific problem, best and quickest results are likely to be secured by those trained in the science involved. The same is true of agricultural engineering problems. They can be best investigated by

those trained in such problems, working in co-operation with other trained agricultural workers.

India is now and is likely to remain a country of small agriculturists. There is scope for the use of larger mechanically powered units, such as are commonly used in western countries, only in restricted localities and for limited uses. While there is very wide scope for the application of engineering principles to Indian agriculture, this application, if it is to be successful, must keep in mind the needs of the present cultivators and of those who will cultivate areas only a little larger than those found at present. Any progress must be along the lines of application to *Indian* agriculture under Indian conditions and not the transplantation wholesale of western practices and western implements developed for entirely different conditions. This is likely to mean the development of a type of agriculture based primarily on animal-drawn power for field work, with the use of engines and electricity largely restricted to stationary work. It seems clear that the objectives discussed in this paper can be achieved without the so-called "mechanisation" of Indian agriculture, that is with bullock-drawn implements, made in India, of Indian materials and by Indian labour. They cannot be achieved without the application of engineering knowledge along with the knowledge of other sciences.

Change and development seem inevitable. The changes envisaged will mean profound changes in the present outlook and in many present social ideas and will eventually mean revolutionary changes in rural, social organisation. These changes are going to take place, whether we think them good or bad. We cannot hope to keep India static when all the rest of the world is changing. We can, if we recognise the inevitability of change and if we understand the factors involved, to some extent guide and direct the changes so as to cause the minimum of suffering and the maximum of benefit; we can get evolution rather than revolution.

"We want an expanding world economy with every one sharing its fruits."

RESISTANT VARIETIES AS A MEANS OF COMBATING PLANT DISEASES

By

Sudhir Chowdhury

The use of resistant varieties was suggested as far back as 1815 by Thomas Andrew Knight who advocated the cultivation of those varieties of cereals which appeared to be immune from attack by certain parasitic fungi.

Considered as a method of control of parasitic diseases, the use of resistant varieties possesses the obvious advantage that it dispenses with the need of other preventive methods. Once resistant varieties of equal cropping power, both in quality and quantity, are produced, the annual tax imposed on the grower by other methods of control is cancelled. From this point of view it is the most economical of the measures available against plant parasites.

Means of Securing Resistant Varieties

There are several ways of securing varieties of plants which are disease-resistant. The methods most often used are :

(*i*) *Introduction* :—It sometimes happens that new varieties or strains of some of our crops, when brought in from foreign countries, prove to be more resistant to certain diseases than varieties which have been grown here for a long time. If these introduced resistant plants are not desirable from other standpoints, for example yield and quality, they may often be used with profit as a starting point for selecting or breeding desirable strains of disease-resistant crops.

(*ii*) *Selection* :—The way of selection is simpler and involves merely the reservation for succeeding crops of those plants which show some degree of resistance. It is thus necessary to have for the successful carrying out of this method a thorough infestation and an indication of resistance on the part of the host plant. This method has been

found of value in a number of cases. In Wisconsin, wilt-resistant cabbage varieties have been developed by saving, as seed plants, individual cabbages which withstood the disease in fields where most of the plants succumbed because of the severe infestation of the soil with the wilt organism.

But the method of selection is too empirical to be attractive from the scientific point of view and following the re-discovery of Mendel's Laws by Bateson and the proof by Biffen that the inheritance of resistance follows these principles, the method of cross-breeding or hybridization has been developed along scientific lines, but this is not applicable in the case of plants which do not flower.

(iii) Hybridization:—Sometimes the process of selection alone does not result in the type of plants desired Perhaps when the investigator finds a variety or an individual which possesses the desired resistance to disease he discovers that other desirable qualities are lacking. He may find a variety of wheat immune to smut but this wheat may be of no value. It may be a poor yielder, have very poor milling qualities and possess many other undesirable characters. But if it is truly immune to smut he may be able to cross it with a variety which has all the other desirable qualities and thus finally breed up a strain which is satisfactory in all respects including immunity to smut.

Genetics of Resistance and Immunity

The study of the manner in which the qualities of the parents are inherited by the offspring has revealed that the agents carrying each specific quality are the chromosomes. At cell division each chromosome splits into two, one half going to each cell, thus maintaining constant the chromosome complement of each cell. At germ cell formation, however, another type of division occurs in which the chromosomes are segregated and recombined, each germ cell containing but half the number of chromosomes (*i.e.*, is haploid).

At fertilization, which involves the union of two germ cells, one from each plant, the number of chromosomes is restored to the normal (diploid) complement. By fertiliza-

tion, therefore, half the hereditary characters of each parent are combined in the offspring and will become manifest or will rest dormant to reappear in subsequent generations according to whether the character is dominant or recessive.

Difficulties Met in Developing Resistant Varieties

Unfortunately, as a method for the control of plant parasites the use of resistant varieties suffers from severe disadvantages. The following are some of the serious obstacles any one or all of which may have to be met and overcome before satisfactory varieties can be developed by selection and hybridization.

(*i*) Immunity to disease is by no means necessarily associated with other desirable qualities in a particular variety. Reimer found certain varieties of Chinese pears which were practically immune to fireblight but these pears were of no commercial value. His problem was to use these varieties of pears as a basis for building up a pear that would be immune to blight and at the same time have a high commercial value. It is manifest that this is likely to be a much more difficult task with the pear than a similar problem with some annual or biennial plant such as the bean or corn would be. As is well-known, pears are ordinarily propagated vegetatively by budding or grafting and the only way to secure any immediate results from the immune varieties is to use them as rootstock on which to grow the commercial varieties. The alternative is to hybridize and trust to luck that after many years' waiting a seedling may fortunately be found which will combine the characters of blight resistance and commercial desirability.

(*ii*) A plant may be found which is resistant to one disease but very susceptible to another disease of equal or greater danger. The value of finding or developing a resistant variety or strain of any particular crop would be greatly enhanced if it were true that a variety which is resistant to one disease were likewise resistant to all other diseases to which the species is subject. While exceptionally hardy varieties which are more or less resistant to diseases in

general are sometimes developed, such as a variety of cowpea resistant to both wilt and root-rot, it is equally true that such coincidence is not always encountered. A variety of apple which is resistant to scab will very rarely be resistant to all other apple diseases. A variety of wheat resistant to smut may be susceptible to rust or root-rot, although some wheat strains which seem to be resistant to most wheat diseases are known. When we take these facts into consideration, along with the fact that our crop plants are nearly always subject to more than one disease, and some of them, such as the potato, to very many, it becomes evident that the problem is greatly complicated. It can readily be seen that even if a variety is developed which exhibits resistance to one disease, it is by no means certain that it will not be susceptible to other diseases of equal or greater importance.

(*iii*) There are in many cases several *biologic strains* of the same organism and while a variety of the host may be resistant to certain strains, it may be very susceptible to another strain or strains. It is now well established that there exist varieties of many of the lower organisms which, although not readily distinguishable morphologically, differ widely in their physiological properties, such as their ability to establish parasitism. To strains of organism showing such differences the terms 'physiologic forms' or 'biologic forms' have been applied Perhaps the most classical example of this phenomenon is that of the fungus causing black stem rust of wheat. Stakman and his colleagues in the United States and Goulden and his co-workers in Canada have now defined over one hundred biologic forms of this organism. Leach has found at least eight distinct biologic forms of the bean anthracnose fungus, *Colletotrichum lindemuthianum.*

It can readily be seen that the existence of so many different forms of a species of parasite complicates the situation very greatly when an attempt is made to select or breed a resistant variety of the host plant. If a variety should be selected or developed which proves resistant to a certain strain of the parasite, there is no assurance whatever that this variety will also be resistant to all the other strains

or biologic forms of the organism. However, in spite of all the difficulties enumerated, it still remains true that the development of resistance and immunity in plants offers a wide field for research and may constitute the only avenue of approach for the control of certain plant diseases.

Artificial Immunization

The question is frequently raised as to whether plants can be immunized to disease in the same manner that animals and man are rendered immune to certain diseases by the use of serums or the production of anti-bodies. Serological methods in inducing plant resistance have been employed by Carbone and his colleagues, who have recorded instances of successful immunization. The generally accepted view is that, owing to the absence of a circulatory system in plants functioning in a manner analogous to the blood system of animals in the translocation of anti-bodies, their action in the plant will be localized. The successful production of resistant plants by immunolgical methods is therefore improbable.

DO YOU KNOW

(1) That the world's production of potatoes is 6,010,000,000 maunds, whereas that of wheat and rice is 3,534,000,000 and 2,411,000,000 maunds respectively ?

(2) That India has the largest groundnut area in the world, the area being 8,500,000 acres, but that, in the beginning of this century, she only had 300,000 acres ?

(3) That the United Provinces produces more barley than any other province in India ?

(4) That the United Provinces produces more sugar cane than any other province in India ?

(5) That the United Provinces has more agricultural colleges than any other province in India ?

AGRICULTURAL DEVELOPMENT IN THE PATNA STATE

By

A. N. Kohli, B. Sc. (Ag.), F. R. H. S. (London.)

Agricultural Officer, Patna State (E. S. A.)

Amongst the states comprising the Eastern States Agency, Patna State occupies a somewhat central position between the Central Provinces on the west and Orissa on the east. This state covers 2,511 square miles and has a population of 6,32,220, according to the latest census. The areas of reserved and protected forests is approximately 420 square miles. The general slope of land being from the south-west to the north-east, four or five rivers flow down eastward through this state and unite their waters with that of the Mahanadi near the adjoining states of Sonepore and Baudh.

The annual rainfall ranges from 50 to 60 inches and the maximum temperature from 54° to 108°F. As one passes from one village to another, one comes across various types of soil, namely, sandy, gravelly, rocky, black cotton, loamy and certain types of alkaline soils locally known as *khalia, chhui*, etc. The topography being highly uneven, rain water for drinking, bathing, washing and irrigation, is stored up in reservoirs. Although there are wells in almost all the villages, their number is limited owing to either the rocky substratum that occurs a few feet below the ground, or, wherever there is alkaline soil, the sides of the well collapse very soon The bulk of the population (not less than 90 per cent.) depend directly upon cultivation and another 5 per cent carry on cultivation as a secondary occupation.

Range of crops :—Paddy is the main crop and several varieties are cultivated both in the low-lying plots and the upland fields. Maize as well as some of the minor millets

like *mandia* (Eleusine coracana), *gurji* (Panicum sp.), are also grown abundantly. Of the pulses *mung* (Phaseolus mungo), var. glabra and var. radiatus (biri), kulthi (Dolichos biflorus) and *arhar* as well as the degenerated varieties of gram, peas, lentils and mustard are cultivated. The indigenous hibiscus (Hibiscus cannabinus), desi cotton and sunn-hemp provide the fibres. For oilseeds they have sesamum, linseed and local mustards. For sugar, rather *gur*, they have Tandi and Bangla varieties of sugar-cane. The local varieties of tobacco not being good for making *biri* (country cigarettes), suitable improved varieties like G/6, Nepani, Hingli, Virginia and Motihari were obtained and supplied to the ryots to replace the local varieties. The state abounds in *kendu* leaves required for *biri* making.

With the accession of His Highness Maharaja Rajendra Narayan Singh Deo an Agricultural Department was established in 1936. A preliminary agricultural survey in some of the villages in each Sub-Division was carried out and a line of work for the development of agriculture on modern lines was adopted. A dual-purpose farm (experimental and demonstration) known as the Rajendra Experimental Farm and a seed farm, known as the Balangir Agricultural Farm, were then started, and varietal, manurial and other experiments began to be carried out on several important crops.

Improvements and innovation :—Paddy is the major cereal here. Seeds of reputed and high-yielding varieties of this crop were obtained from Government farms, far and near, and tried side by side with the local varieties. After repeated experiments for two or three years, the promising varieties are distributed amongst the ryots of the state. Thus about 600 mds. of seeds of Kankesal, Cuttack No. 3, Dahia, Buromal and Dehradun Basmati varieties have been distributed.

The introduction of the high quality strains of wheat like P/4, P/12, P/52, P/100, C/13, C/518, C/519, A/113 has been quite a success. Only the *desi* variety giving a lower yield than the above and producing *ata* (flour) of

a pinkish-white colour was cultivated by well-to-do people and Brahmins. The masses were practically ignorant of its cultivation. The ryots were soon convinced of the superiority of these improved varieties. Moreover, they were instructed to take it as a second crop following one of sunn-hemp or paddy on irrigable plots, after the application of sufficient manure. When grown after a crop of sunn-hemp the combined income of the two crops is sometimes far above the expectation of the humble cultivator. More than 100 mds., of the improved types of wheat seed have been distributed so far.

Formerly the seed-cane locally known as Tandi and the chewing cane variety, Bangla, were the only varieties of sugarcane for making jaggery. Co/213 made its first appearance here during the time of the late Maharaja Prithwiraj Singh Deo. The Agricultural Department brought in several improved strains, adding a few new varieties every year. Thus there are growing in the farm under different conditions the varieties Co/213, Co 313, Co/331, Co/421, Co/419, Co/281, Co/435, Co/436, Bo 5, Poj/2878, Hm/613, Hm/609, Java/55, J/247 and Mauritius. Amongst these varieties Co 421, with its tall growth and numerous tillerings has already become a popular cane among both zamindars and cultivators. Demonstrations on the trench method of growing sugarcane are given on the cultivator's own field. More than 400 mds. of cane sets mainly of Co 421 have been distributed this year.

Experiments with four varieties of cotton *i.e.* Cambodia, Gadag, U.P.-Punjab cross and Madras-American have shown the decided superiority of Madras-American cotton to the others. The ryots were shown the correct method of sowing and the proper seed-rate on their own fields. There being stretches of black-cotton soil here and there this crop gives a good profit, except in years of heavy rainfall during the sowing season or in the following season. This success of the American variety has attracted the notice of the All-India Spinners' Association and the Orissa Agricultural Department. Not less than 100 mds. of seeds of this variety has been distributed amongst the growers.

As groundnut is suitable for sandy land, experiments were carried on varieties like Akola, Kanke 17, and Big Japan. The plants thrive very well here but as soon as the nut begins to form, two night pests, namely wild boars and jackals, from the neighbouring hills, and another during day time, the crow, devour most of the raw nuts before they are mature. This has discouraged many cultivators. However, there are some villages which are somewhat far from the hills and jungles. On the sandy lands of such villages cultivation is being pushed on. About 15 mds. of such seed have been distributed up till now.

Potatoes sell at a comparatively high price in the local markets. The humbler people, who use few vegetables in their diet, never care for potato cultivation. In fact, only a limited few know how to grow it. Realising the necessity for introducing the cultivation of potatoes on a large scale, as irrigable loamy soils are found in most villages, the Department has tried plains, hill and foreign varieties on the Rajendra Experimental Farm and distributed nearly 50 mds of "seeds" to the cultivators.

New Vegetables:—Country vegetables of several sorts grow here, but one will hardly find more than one or two varieties at a time in one village. So the Department has been instructing the people in growing vegetables in all seasons, that is during the summer, monsoon and winter. Very few know how to grow cauliflower, cabbage, knol-khol, peas, carrots, turnips, etc. Superior seeds from renowned firms were obtained and tried on the Farm and some were distributed among the people with instructions. The profit made soon encouraged the cultivators and the demand increased. Over Rs. 600 worth of seeds of summer and winter vegetables have been supplied this year.

After experimenting on the Farms, the Department has distributed Cawnpore *arhar*, Soya beans, tobacco, superior peas, kabuli gram, linseed and various types of fruit grafts to the cultivators.

Agricultural Implements:—The implements in use here serve their purpose to some extent. They are made by

the villagers themselves out of the wood from jungles. Their cost is practically that of the iron parts only. Demonstrations of modern ploughs like the Punjab plough, the Victory plough, the Planet junior hoe, the Kirloskar Kumar and Karamat cane crusher, the round gur Pan over the round furnace, the chaff-cutter, etc., are given whenever visitors come to the Farm. The leading Zamindars, being already convinced of their superiority, have obtained some of these for their estates.

Wild animals being a serious pest to crops, a simple detonating gun for frightening them away is manufactured under the direction of the Department and this is then distributed in areas infested with wild boars, bears, etc.

Useful Propaganda:—The propaganda of the Department is carried on by the Agricultural Officer, the Agricultural Inspector, and two Agricultural Overseers who visit a number of villages in each Sub-Division. Over 100 villages are visited in a year by each of them.

Magic lantern lectures are frequently given by the Agricultural Officer in the central villages. Thus, during the last four years, 60 shows were given for about 20,000 people from 800 villages.

Leaflets on the cultivation of important crops, crop-pests and other subjects are published from time to time in Oriya, a local language. Besides this, short articles on agricultural subjects are contributed to the State Weekly Journal, The Patna Dipika.

The Department also arranges for annual gatherings of cultivators when different activities of the Department are explained by means of suitable demonstrations, lectures and magic lantern shows.

In addition to this, agricultural and industrial exhibition are held from time to time, in which all the Development Departments participate. The Department also takes part in exhibitions in neighbouring states or British Provinces.

Animal Husbandry and Dairying:—Side by side with the Agricultural Farm in the state, there is an up-to-date

(*Continued on page* 108)

A TRIP TO BHADRI

By

S. R. Barooah, B.Sc. (Ag.), M.Sc. (Agri. Bot).

Department of Agronomy, Agricultural Institute, Allahabad

When I was a student of the Agricultural Institute, Allahabad, I heard a lot about the big mela at Bhadri and the farm at Baiti, which are run by the same family. So I jumpedat the idea, when some of our senior students proposed a trip to Bhadri. With the approval of my respected teacher, Mr B. M. Pugh, I wrote to Mr. T. P. Singh to arrange for our accommodation, and we started in the early hours of 19th December. The group consisted of Mr. B. M. Pugh, eight senior agronomy students and myself. Bhadri is a small station in the Allahabad-Lucknow line, and though it is only 30 miles from Allahabad, it took us about two hours to reach Bhadri.

On our way to the palace we found Mr. Rajpal Singh, who finished the Intermediate course at the Allahabad Agricultural Institute in 1939. He was very happy to meet us there, and acted as our guide as long as we stayed there. Since leaving the Institute Mr. Rajpal Singh has been working as manager of the small farm attached to the palace.

After a few minutes the youngest brother of the Raja Sahib, Mr. Bhadriswar Prasad Singh, came to meet us. He was very kind and courteous. As the Raja Sahib is busy with politics and other public affairs, Mr. B. P. Singh looks after the management of the estate. After tea we all went out to see the farm and the cattle which are attached to the palace.

The Raja Sahib is very much interested in agriculture and because of his interest was appointed by the United

Provinces Legislative Assembly in 1939 a member of the Agricultural Reorganisation Committee. The Raja Sahib keeps cows of the Sahiwal breed and cross-bred Holsteins. The farm attached to the palace is of about 75 acres with facilities for canal irrigation. The soil of the farm is sandy loam, in which are grown all kinds of crops, but mainly wheat, gram and peas. A portion of the land is under vegetables and tapioca. Also there was a citrus and a guava orchard, but due to lack of time we could not go to see it. At about one we came back to the palace, and after our lunch were ready to start for Baiti.

Baiti is about five miles from Bhadri The conveyances from Bhadri to Baiti are horse carts, or cars of the palace We went in a two-seater car with some accommodation in the back As the other cars were not there, all eight of us squeezed into the two seater car. As the road was dusty, when we got out at Baiti, the boys who were at the back were all full of dust. It was difficult to recognise them. They looked like modernised 'sadhus' or 'pahlwans' coming out of 'akharas'. But we thoroughly enjoyed the ride. We arrived there about 2-30 p.m. and met Mr. T. P. Singh, who was waiting for us. It was really a happy occasion to meet him—one of our old students who has taken to large scale farming, and who, casting luxury aside, has taken to a hard farmer's life. He has been working there for the last ten years and has developed the farm into a great commercial concern. He has not only spent his money but has devoted his time and energy to this glorious profession.

The Baiti farm is of about 3000 acres. This farm also has got facilities for canal irrigation. We were told that the farm once belonged to a Captain Chapman, who had extensive indigo cultivation, traces of which we found when we went round the farm. The most important crops of the farm now are wheat and paddy which are grown extensively. The farm lies near the Ganges and is annually flooded by that river. Because of this condition, only rice can be grown in the *kharif* season and wheat in the *rabi* season when the water goes down. For wheat the land is ploughed

only once, as very little time is left after the fields get cleared of water. Hence very little labour is needed for the preparation of the land. The land is mostly ploughed with the help of tractors. As drilling is not practicable, seeds are sown by broadcasting. The variety of wheat grown is Pusa 52, as the Government has a standing contract to buy all the grain that can be spared The farm also grows different kinds of vegetables and spices and includes a few orchards, mainly of citrus, banana and papaya.

Mr. T. P. Singh has not confined himself to crops but has extended his interests to animals also. Since 1931 he has been trying horse breeding with Arab stallions. He has about 30 mares which are beautiful and very docile. They all came to us when we entered the corrals to see them. But due to shortage of medicine he is now finding difficulty in managing them, as some of them are suffering from worms. Along with horse breeding he tried camel breeding which has had to be given up due to lack of medicine. Side by side he has a small poultry farm where different breeds of fowls are kept. At present there are about 150 birds. The breeds he is maintaining are White Leghorn, Rhode Island Red and Minorca. Mr. Singh has tried breeding of tropical fish also, but due to the war he has stopped it.

The thing that interested us most is the method he is using to improve the village cattle. He has requested the villagers all around to come to his farm and get their cows served by the Sahiwal bulls free of cost; and along with this he has told them that they can bring their cows for grazing on his waste land if they castrate their scrub bulls. He gives the service of his veterinary doctors free to the villagers. He has in this way achieved marvellous results. We feel proud that one of our old students has been doing such humanitarian work for the progress of his poor tenants. It is really a great pleasure to see a man who has used all his wealth, time and energy for the betterment of his poor countrymen.

After seeing the farm we returned to the home of Mr. T. P. Singh and had tea on the lawn where two of our old lady graduates Miss Hari Rajkumari Singh and Miss Shanti

Rajkumari Singh (the nieces of the Raja Sahib) were waiting for us. We had a very pleasant time with all of them, and for a long time we talked about our old college days. As it was getting late and as we had to return to Bhadri for the night, some of us started off in the two seater car and the rest were given a pleasant ride by Mr. T. P. Singh in his four-horse chariot. It was a moonlit night, and we felt as if we were riding along the high ways of the old Greek Empire.

We came back to the palace, and after a hot discussion on the future of mechanised farming we were joined by Mr. B. P. Singh who after our dinner took us to the inner circle of the palace to show us the different varieties of lilies which the Raja Sahib has imported from America. There were about 40 different varieties. It was a lovely spot, and, as the moon was casting its soft rays on us, we were intoxicated with romantic feelings, and felt as if we were in dream land. There were roses also surrounding this small pool. The rose garden which has been newly established in that spot has about 300 different kinds of roses. These two things impressed us so much that next morning we again came to see them and to watch their beauties in the broad daylight.

After our breakfast we started for the station where we were met by Mr. T. P. Singh and the Singh sisters who came to see us off. We all enjoyed our trip thoroughly and we remain ever grateful to the Singh brothers and their family for their kindness and hospitality.

"In the last reckoning all things are purchased with food. Such is the fateful and awful truth that hideous famines make known. World-wide war that to-day is strangling civilization further shows up the enormity of this fact. Food is necessary for victory. Food is rationed by aggressors to subjugate rebellious peoples of occupied countries. People will sell their liberty, their all for food when driven to extremes of this tragic choice. There is no substitute for food."—WALTER C. LOWDERMILK.

RURAL CHRISTIAN FELLOWSHIP NEWS—REPORT OF THE TWO-BY-FOUR EXHIBIT

By

N. M. West,

Pithoragarh, Almora

In 1927, the Prem Sabha asked me to talk on better methods and techniques of farming. One point I mentioned was an exhibit of products. Thinking about it later I advertised an exhibit. The people did not know what to exhibit. They had to be told. That first year about half of the exhibits were pumpkins of all varieties and sizes and grades There were a dozen or more other things displayed. The exhibits came from the immediate neighbourhood. Most of them were solicited. After that first one every one went home quite pleased with themselves. Most of the attendants were the exhibitors or their relatives or neighbours. The grade of specimens with which people were pleased the first year, were left at home the next year.

Each year people now inquire when the exhibit is to be and watch the weather and watch their products and choose weeks before date what they are going to exhibit. Each year people exhibit who have not shown anything previously. Each year exhibits come from villages from which none have come before. The crowd increases in number, and places from which people come.

In 1941 there where six vegetables shown which had never been shown before 1941. The quality of exhibits has greatly improved. There is no longer the small, misshappened, low grade specimens shown.

There are many things yet lacking, many things to be changed or added, but we are making progress.

UNITED PROVINCES DEPARTMENT OF AGRICULTURE, MONTHLY AGRICULTURAL REPORTS.

NOVEMBER, 1942.

I—Season.—During the month under report there was no rain in any part of the Province except for some light showers in the Almora District.

II—Agricultural operations.—Agricultural operations are generally up to date. Sowing and irrigation of *rabi*, harvesting of *kharif*, picking of cotton and crushing of sugar cane are in progress.

III—Standing crops and IV—Prospects of the harvest.—The condition of the standing crops and the prospects of the harvest are on the whole satisfactory except in dry areas where more rain is needed.

V—Damage to crops.—Damage to crops due to locusts is reported from the Muzaffarnagar and Meerut Districts and due to floods from the Bijnor and Etawah Districts.

VI—Agricultural stock.—The condition of agricultural stock is on the whole fairly satisfactory Cattle diseases have been reported from a number of districts. From Table 1, prepared from data supplied by the Director, Veterinary Services, United Provinces, it would appear that there has been on the whole a marked decline since the last month in the number of seizures, deaths and mortality from cattle diseases. The decrease in the number of seizures and deaths has been most pronounced in the case of Hæmorrhagic Septicæmia, Rinderpest, Foot and Mouth diseases and "Other Diseases." There has been an increase since the last month in the number of seizures, deaths and mortality from Anthrax. In the case of Blackquarter, however, there has been an increase in the number of seizures but a decrease in the number of deaths, so that mortality has declined.

Table 1.—Number of seizures, deaths and mortality from cattle diseases in October and November, 1942

Diseases	Seizures		Deaths		Mortality	
	October	November	October	November	October	November
Anthrax .	6	14	5	14	83	100
Hæmorrhagic Septicæmia ..	464	67	414	64	89	96
Blackquarter ..	9	11	6	4	67	36
Rinderpest ..	1,505	528	603	273	40	52
Foot and mouth .	5,440	3,723	17	13	0·31	0·35
Other diseases ..	62	3	11	..	18	..
Total	7,486	4,346	1,056	368	14	8

N.B.— Mortality $= \frac{\text{No. of deaths}}{\text{No. of seizures}} \times 100.$

VII Pasturage and fooder.—Sufficiency of pasturage and fodder is reported from every where except in the Bulandshahr, Moradabad, Sahjahanpur, Etawah, Fatehpur, Unao, Rae Bareli and Sitapur districts, where some scarcity is reported.

VIII—Trade and prices.—In Table 2 are given the retail prices of important agricultural commodities in rupees per maund at the end of the month under review and of the preceding month. From this it would appear that there has been an increase since the last month in the prices of all commodities, and this is most pronounced in the case of rice and *arhar*.

Table 2. Retail prices in rupees per maund of Agricultural commodities for November and December, 1942

Commodities	Retail prices	
	November	December
Rice . .	10·021	10·765
Wheat	7 918	8·125
Barley	6 483	6·842
Gram	7·079	7·569
Arhar	9·797	10·849

IX.—Health and labour in rural areas.—The condition of labour in rural areas is on the whole satisfactory, although cases of smallpox, cholera, plague and seasonal fever are reported from some districts.

DECEMBER, 1942.

I—Season.—During the first week of the month under report, there was no rain. Light showers were received in a few districts during the second week. During the third and fourth weeks, the rainfall was widespread throughout the Province, the Dehra Dun District recording the highest.

II—Agricultural operations.—Agricultural operations are generally up to date. The irrigation of Rabi crops, crushing of sugarcane, the preparation of land for sugar cane and in some districts, for zaid crops, are in progress.

III—Standing crops and IV—Prospects of the harvest.—The condition of the standing crops and the prospects of the harvest are on the whole satisfactory, except in the Budaun, Etawah, Jalaun and Sultanpur districts where more rain is needed. The yield of sugar cane is estimated at 118 per cent., of the normal.

V—Damage to crops.—Damage due to hailstorms is reported from the Shahjahanpur, Basti, Fyzabad, Sultanpur, and Bara Banki Districts, due to floods from the Muzaffarnagar District and to locust, from the Bulandshahr District.

VI—Agricultural stock.—The condition of agricultural stock is on the whole fairly satisfactory, although cattle diseases have been reported from a number of districts. From table 1, prepared from data supplied by the Director, Veterinary Services, United Provinces, it would appear that there has been on the whole an increase since the last month, in the number of seizures, deaths and mortality from cattle diseases. The increase in the number of seizures, deaths and mortality has been most pronounced in the case of Rinderpest. In the case of Foot and Mouth disease, there has been a marked increase since the last month in the number of seizures but a slight decline in the number of

deaths, so that mortality has declined. In the case of Hæmorrhagic Septicæmia there has been an increase in the number of seizures and deaths but a decrease in mortality. In the case of Anthrax, however, there has been a decrease in the number of seizures and deaths, but the mortality in both this as well as the preceding month has been 100 per cent. No case of seizure and death from Blackquarter has been reported during the month.

Table 1.—Number of seizures, death and mortality from cattle diseases in November and December, 1942

Diseases	Seizures		Deaths		Mortality	
	November	December	November	December	November	December
Anthrax ..	14	5	14	5	100	100
Hæmorrhagic Septicæmia ..	67	84	64	70	96	83
Blackquarter ..	11	0	4	0	36	0
Rinderpest ..	528	778	273	437	52	56
Foot and mouth ..	3,723	4,220	13	11	0·35	0·26
Other Diseases ..	3	4	0	0	0	0
Total ..	4,346	5,091	368	523	8	10

VII—Pasturage and fodder.—Pasturage and fodder are reported to be sufficient everywhere except in the Moradabad, Shahjahanpur, Etawah and Sitapur Districts where some scarcity is reported.

VIII—Trade and prices.—In Table 2 are given the retail prices of important agricultural commodities in rupees per maund at the end of the month under review and of the preceding month. From this it would appear that whilst the price of barley has remained almost stationary, there has been a rise in the prices of rice, wheat, gram and arhar.

Table 2.—Retail prices in rupees per maund of agricultural commodities for October and November, 1942

Commodities	Retail prices	
	October	November
Rice	9·646	10·021
Wheat	7·554	7·918
Barley	6·300	6·483
Gram	6·595	7·079
Arhar	9·103	9·797

IX—Health and labour in rural areas.—The condition of labour in rural areas is on the whole satisfactory although cases of cholera, plague, small-pox and influenza are reported from some districts.

(*Continued from page* 98)

Farm, the only one of its kind on this side of India. Here pure Sindhi and Hariana breeds of cows and Murrah buffaloes are kept to supply milk for the palace, the hospitals, and to the residents of the capital. High class ghee, butter and ice-cream are also produced.

Besides growing Napier and Guinea grasses for green fodder, silage of different grasses is made and fed to the cattle.

In the proclamation on his Birthday ceremony. the Ruler made a free gift of 26 bulls to those villages which would care to maintain them properly. In this way 41 superior bulls have already been distributed to important villages and it has been planned to supply every village group in the state with such an animal in about 12 years' time.

The average yield of rice per acre in India during the three years 1936-37 to 1938-39 is 814 lbs.; whereas the average yields of the United States, Japan, Egypt and Italy during the same period is 1,481 lbs., 2,307 lbs., 2,079 lbs. and 3,000 lbs. respectively.

REVIEW

THE PRESERVATION NUMBER

(*The* 1942 *Annual Number of the Punjab Fruit Journal*)

Foreword by the Hon'ble Rao Bahadur Ch. Sir Chhotu Ram, Minister for Revenue, Punjab.

Edited by S. B. S. Lal Singh, Fruit Specialist, Punjab, Lyallpur

and

Dr. Girdhari Lal, Bio-Chemist, Fruit Products Laboratories, Lyallpur.

Available from The Punjab P. C. Fruit Development Board, Lyallpur.

"There is an extreme dearth of authentic literature dealing with fruit and vegetable preservation pertaining to Indian conditions, as books written by foreign authors do not fully answer our purpose. There was, consequently, a keen demand for the publication of suitable literature on the subject. And this demand has been still further intensified by the present war inasmuch, as importation of foreign products has almost completely stopped, there is need for local production, and in fact, a rare opportunity to develop this industry when it can have a normal chance of survival without being strangled by foreign competition."

Keeping the above in view, the Punjab Fruit Development Board, which has earned a reputation for bringing authoritative literature on gardening suitable to Indian conditions, has devoted the fifth Annual Number of the Punjab Fruit Journal exclusively to the Fruit and Vegetable Preservation Industry. We congratulate our contemporary in completing its first quinquennium and for establishing itself as a successful venture in horticultural journalism in the East.

This compendium will surely be of immense use to those who are interested in Fruit and Vegetable Preservation and will be welcomed alike by research scholars and commercial magnates.

It is a handy illustrated Annual comprising seventy (70) pages replete with facts essential for starting the Preservation Industry both as a war and post-war measure. Some of the most informative articles in this 'souvenir' are:

Future of Fruit Preservation Industry—War and the Preservation Industry—Facilities for Training in Fruit Preservation—Equipment for a Fruit Preservation Factory—Preparation of Citrus Fruit Squashes and Cordials—Preparation and Preservation of Unfermented Apple Juice—Preparation of Jam from pears and plums—Tomato Ketchup—Tomato Juice—Guava Cheese—Pickling of Vegetables—Drying of Vegetables—Vinegar Manufacture for Home Use—Control of 'Spoilage' in Canned Foods—Summary of the work done in Fruit and Vegetable Preservation at the Fruit Products Laboratories, Lyallpur—Directory of Firms Supplying Fruit Products and Fruits.

This Number is priced at Re. 1-8 including postage on pre-paid Money Order basis or V.P.P. basis; but to regular subscribers of the journal and the members of the Punjab Fruit Development Board, this Number along with other issues of the journal is supplied free. The Annual subscription of the journal is Rs. 3 on pre-paid Money Order basis and Rs. 3-8 per V.P.P. basis.

NOTE:—Popular abridged Urdu Edition of this Special Preservation Number, comprising 40 pages of the reading matter priced at Re. one including postage on pre-paid Money Order basis or V.P.P. basis, is also available for sale.

For further particulars please write to—

THE HONY. SECRETARY,
Punjab P. C. Fruit Development Board, Ltd.
Punjab Agricultural College, Lyallpur (India)

Registered No. A-925

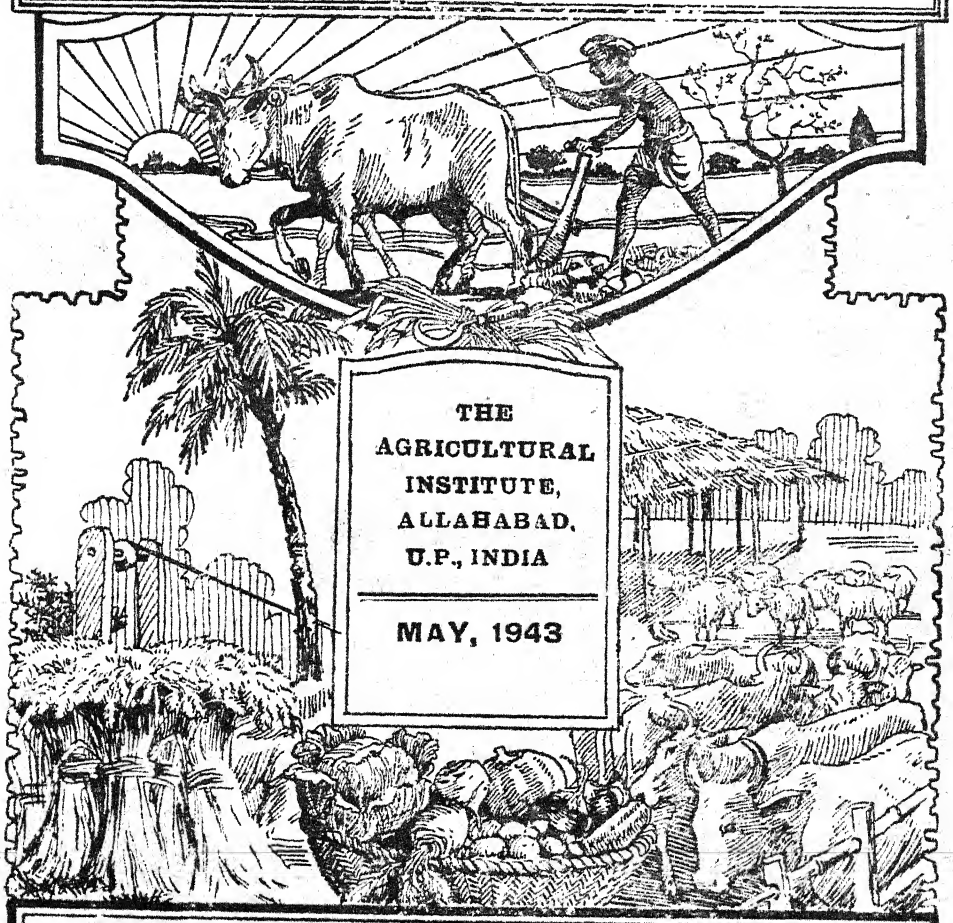
VOL. XVII] [No. 3

THE ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life



THE AGRICULTURAL INSTITUTE, ALLAHABAD, U.P., INDIA

MAY, 1943

I often think, when working over my plants, of what Linnaeus once said of the unfolding of a blossom: "I saw God in all His glory passing near me, and bowed my head in worship."

—JOHN FISKE.

Rules for the Award of the Prize for detecting an Effective Pest or Disease on Tokra without endangering Tobacco and other Crops

—:o:—

1. The prize shall be Rs. 3,000 and shall be awarded by the Tobacco Market Committee, Guntur.
2. The prize shall be in cash.
3. The award shall be made under the conditions specified hereunder to the discoverer of a pest or disease on tokra (Orobanche sp.) occurring on tobacco in the Guntur District.
4. The pest or disease shall be injurious to the tokra in such a way that the occurrence of tokra is considerably minimised, if not prevented. The pest or disease should not endanger tobacco or any other crop grown in the Guntur District or adjoining districts.
5. It shall be the concern of the discoverer to demonstrate at his cost successfully for two years the efficacy of the pest or disease discovered on a 5-acre tokra infested plot selected by the Committee.
6. The award of the prize shall be subject to the recommendation of an Expert Committee of Scientists, to which the pest or disease and the results of the demonstration will be submitted for scrutiny.
7. The Tobacco Market Committee reserves the right over the discovered pest, or disease, and the results of demonstration.
8. Papers submitted in this connection shall be the property of the Tobacco Market Committee which reserves to itself the right of publishing all or any of the papers.

—:o:—

Rules for the Award of the Prize for Inventing Commercial and Useful Methods for the use of Tokra Plants

1. The prize shall be Rs. 2,000 and shall be awarded by the Tobacco Market Committee, Guntur.
2. The prize shall be in cash.
3. The award shall be made to the inventor of a commercial or domestic use for the tokra calculated to consume tokra in large quantities before the setting of seed. Preference shall be given to the discovery of a commercial use which would encourage any rural or cottage industries, as it will be more desirable in the interest of villages. The method shall prove profitable with a decent margin of profit.
4. It shall be the concern of the inventor to demonstrate at his own cost the method for the utilisation of the tokra in large quantities and the sale of the manufactured product.
5. The inventor may reserve for himself patent rights over the method.
6. The award of the prize shall be subject to the recommendation of an Expert Committee to which the invention and the product thereof shall be submitted for scrutiny.
7. The Tobacco Market Committee reserves to itself the right over the award of the prize and over any papers submitted in this connection whose publication shall be vested in the Tobacco Market Committee, Guntur.

THE ALLAHABAD FARMER

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

The Allahabad Farmer is now approved by the Directors of Public Instruction in the United Provinces, Bengal, Central Provinces, Sind, Assam, Bihar, and Orissa, the Rural Reconstruction Commissioner, Punjab, and by the Director of the Institute of Plant Industry, Indore, and Agricultural Adviser to Rajputana and Central India States, for use in all schools under their jurisdiction.

Subscription Rates

Annual subscription : India, Rs. 3; England, 4 shillings; U.S.A., 1 dollar. Single copies, 10 annas; over five years old, 12 annas. Copies which are not received by subscribers will be supplied free of cost within six months of the month of issue. Thereafter single copy prices will be charged.

Unused portions of subscriptions cannot be refunded.

Advertising Rates	Rs.	a.	p.
One full page of six numbers	35	0	0
One single full page	7	0	0
One half page of six numbers	20	0	0
One single half page	4	0	0
Page 2 or 3 of cover for six numbers ...	50	0	0
Page 4 of cover for six numbers	70	0	0

Contributions

The Allahabad Farmer is published in the first week of each alternate month commencing with the month of January. Contributors are requested to send in their articles at least one month prior to the next prospective date of publication.

Contributors will receive 15 reprints of the article published and additional copies at cost.

Publisher—The Allahabad Agricultural Institute, Allahabad, U.P. (American Presbyterian Mission).

Printer—The Mission Press, Allahabad, U. P.

Business correspondence should be addressed to the Business Manager, Allahabad Farmer.

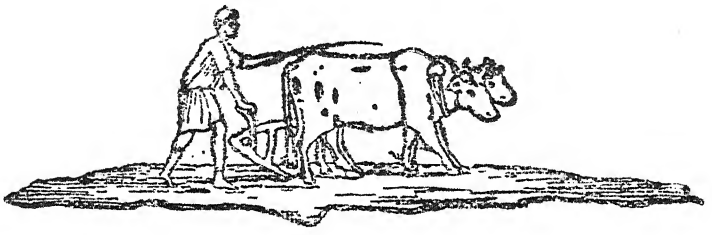
The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

Vol. XVII] MAY, 1943 [No. 3

Table of Content PAGE

THE ALLAHABAD FARMER



VOL. XVII] MAY, 1943 [No. 3

Editorials

Agriculture and the National Welfare.

The problem of food and clothing that exists in the country to day has given every one of us a rude shock and has awakened us to the fact that National welfare, nay, even our life, depends a great deal upon the agricultural situation in the country. The eyes of everyone now are towards the farmer who, it is hoped, somehow or other, will do something to satisfy our needs, which, it seems to many, are becoming more and more acute. The questions that may arise in the minds of many people in this country are perhaps these: "Why is it that India with such a large agricultural population cannot produce enough food and clothing for its starving population? What methods are necessary in order to stimulate production?" There are, we are sure, a thousand and one answers to these questions. But some of the most obvious to us at the present time are the following :—

1. The improper use we, as a nation, make of the land. Not only are there to-day millions of acres of culturable lands that are lying unused but land that is being used at present is being allowed to deteriorate through soil erosion,

deforestation, and undesirable systems of tenancy and for various other reasons. Land utilization is therefore, in our opinion, a national concern. We would, therefore, suggest at this juncture, the creation of a Government Soil Conservation service, whose function will be to find out ways and means for the maximum and best use of the land.

2. Another possible method of approach is what M. L. Wilson, Director of Extension Work of the United States Department of Agriculture, calls a "cultural approach". The farmers must be given a "new pattern of farm life". This probably carries the same idea as the "New Life Movement" in China. We know that our farmers have an emotional attachment to old ways which cripple them. Hence we believe that it will be in the interests of the nation, if some of their habits, traditions and even moral ideas and anti-national and devitalizing institutions be done away with. Such an approach, however, can only be made if the right kind of teachers—teachers with a vision and a high sense of their calling—are available. We would also suggest the creation at the same time, or side by side, of a Government national rural organization whose function it would be to see that books on agricultural and rural life are produced and made available to those people in the villages who can read them. Books on all aspects of agriculture and rural-life, costing an anna to four annas each, should be produced in great quantities and should be placed in each rural or village school library which should be available to the people of the villages. These schools, through these new types of village school teachers, should be centres of culture, and not simply places where school teachers can earn their livelihood. That is, through the teacher, such journals as the "Hal" should reach the farmers of his locality. The school should also be a centre for greater development of music, for community festivals, dramatic presentations and for the presentation of science and the economics of the village to the farmer. It has been our experience, when we visit villages, to find people who almost any time would be willing to pay half an anna to one anna for almost any book that they can read. The thirst for knowledge and information does exist even in the villages,

and that should be stimulated by supplying them with books which are related to the life they live.

3. Another indirect method of increasing the food available in the country would probably be a change in our food habits. Under the pressure of the wheat shortage, people are now being forced to eat other food grains. But it seems to us that the nation as a whole should make every effort to encourage people to eat other things which are nutritive, not only to supplement but also as substitutes for the kind of food they eat now. At present we hear of a rice famine in Bengal and a wheat famine in Northern India. One good thing that this war has done is to make people find all kinds of substitutes for the food they used to eat. Thus we learn that in England to day a common weed which they call purslane and is known in the United Provinces as *kulfa* or *lona* is becoming a very common source of greens or pot-herbs (*sag*) for the people of that country. There is, therefore, we believe, great room for a change in our food habits in this country also. Bengal and Assam eat too much rice, whereas the provinces of Northern India can perhaps afford to eat less wheat. By doing this we can perhaps avoid the same kind of fate which came to Ireland, when about a million of her people years ago died of starvation simply because there were not enough potatoes, as the result of that disease known as the late blight of potatoes.

In this connection we wish to draw the attention of the readers to an article by Dr. E. G. Wilkins, in the December 1942 issue of the "Indian Farming" in which he pointed out that the flour prepared from the kernels of the mango seed is about as good as rice as a food, and that this flour is now being used in the Kond hills.

This is the most opportune time for our nutrition experts to tell us what food stuffs are available which can be economically used by the mass of our people in this country.

4. Our other suggestion is that in the times of food scarcity each province should have an extension officer whose main duty it would be to push the growing of certain crops or varieties of crops that will give the greatest amount of

food to the people of each province. Up till the present our research officers have very often done the work of the extension officers also. This has very often produced very bad results in the end.

A complete divorce of the work of the extension officer, from that of a research officer, we believe, would do a lot of good to the country. We regret, however, to note that very often a research officer, because of his seniority in service, is promoted or transferred to administrative posts to the detriment of the research work.

We note, therefore, with a feeling of satisfaction the appointment in these provinces of an additional Director of Agriculture whose main function is to stimulate production for war purposes.

5. Finally, we would again stress the importance of making use of all town and city wastes for agricultural purposes; the boring of tube wells for irrigation purposes, and many other devices which will increase the facilities of the farmer.

Manure and Fertilizers.

Beginning with this issue we plan to publish a series of articles on this subject by Mr. S. C. Chowdhry. The articles, when finished will be compiled in book form and may be used by students of agriculture as an Indian book on the subject.

IMPERIAL DAIRY RESEARCH INSTITUTE.

The Imperial Dairy Research Institute, Bangalore, has been authorised by the Government of India to entertain Honorary Research Workers, who are graduates of Indian and European Universities and who are desirous of carrying out research work at the Institute. Such candidates as are suitable and well qualified for dealing with a problem within the purview of the work and activities of the Institute will be selected. The number of workers to be admitted will be limited to two at present and their period of research work will not ordinarily exceed one year.

MANURES AND MANURING

BY

Sudhir Chowdhury

CHAPTER I.

Historical

The use of the dung of animals and of chalk, marl, wood ashes, and certain other substances for increasing the productivity of the soil, was known not only to the early Greeks and Romans but apparently also to the Chinese whose employment of them for such purposes probably far antedates all human records. Indeed, Mago, the king of Carthage, in his work on agriculture, which won for him from his enemies, the Romans, the designation 'Father of Agriculture' wrote of the value of bird manure, praising especially that of pigeons, and Cato (born 234 B.C), the first Roman agricultural writer, gave to bird manure the first place. The manurial effect of various miscellaneous substances and of certain legumes was also well recognised not only by the agricultural writers Varro (39 B.C.) and Columella (50 A.D.) but even by the poet Virgil, for the latter in speaking of ashes and dung says:

"But sweet vicissitudes of rest and toil make easy labour and renew the soil;

"Yet sprinkle sordid ashes all around, and load with fattening dung the fallow ground."

Nevertheless, although the beneficial effects of manuring have long been recognised, it is only since the beginning of the last century with the development of the science of agricultural chemistry, that any accurate knowledge has been obtained of the functions of manures and the principles of manuring. One of the first questions which suggests itself in connection with the functions of manures and the principles of manuring is: of what materials are plants made up and from whence do they obtain them?

To this question no satisfactory answer could be given by the earlier chemists. They were too much addicted to explaining natural phenomena by recourse to imaginary

'first principles' or 'elements' (the latter word, however, not being used in its modern sense, but rather as representing such qualities as 'hotness', 'dryness', 'coldness', or 'moistness'). For example, some of the alchemists attribute plant growth to a 'balsamick saline juice', present in fertile, but deficient in barren soils. One of the earliest theories as to the nature of the food of plants was that of Joannes Baptista van Helmont, one of the best known of the alchemists who flourished about the beginning of the 17th century. Van Helmont believed that he had proved by a conclusive experiment that all products of vegetables are generated from water.

"He took a given weight of dry soil—200 lbs.—and into this he planted a willow tree that weighed 5 lbs., and he watered this carefully from time to time with pure rain water, taking care to prevent any dust or dirt falling onto the earth in which the plant grew. He allowed this to go on growing for five years and at the end of that period, thinking his experiment had been conducted sufficiently long, he pulled up his tree by the roots, shook all the earth off, dried the earth again, weighed the earth and weighed the plant. He found that the plant now weighed 169 lbs. 3 ozs., whereas the weight of the soil remained very nearly what it was—about 200 lbs. It had only lost 2 ozs. in weight." The conclusion, therefore, come to by van Helmont was that the food of plants was water.

The next theory as to the nature of the food of plants was that of Jethro Tull, which when it was first published created a considerable amount of interest. About 1700 Jethro Tull convinced himself that the growth of plants depended upon the fineness of the particles of the soil in which they were grown, and in a book which attained some celebrity—'Horse-hoeing Husbandry', the first part of which was published in 1731, he taught that the use of manure was unnecessary if the soil were mechanically reduced to a sufficiently fine state of sub-division. Therefore he argued if this work of pulverization can be effected more cheaply by tillage operations, manures might be dispensed with. According to Tull the food of plants consists of the particles of the soil.

The first serious effort to get at the facts about the food of plants was made in 1755 by Francis Home who was requested by the Edinburgh Society for the Improvement of Arts and Manufacture 'to try how far Chymistry will go in settling the principles of agriculture'. He recognised that the central purpose of agriculture was the feeding of plants and therefore began to study this, adopting two methods that have since been followed by many other investigators: the analysis of the plant to discover what is in it, and the testing in pot experiments of the effects of various substances on plant growth to discover those that are of real nutritive value. Home himself did not get far with the problem but the introduction of the method by which it would be solved was a great achievement.

Further advances were made by Priestley in England and by Ingenhousz and Senebier in Geneva. In 1772 Priestley discovered that combustion and the respiration of animals deteriorate the air and lessen its volume but that plants can render it again capable of supporting combustion. This observation coupled with his discovery of oxygen led to the recognition of the fact that the bubbles already observed by Bonnet on leaves when they were immersed in water, were chiefly oxygen. It was then shown by Ingenhousz that these phenomena were caused by the action of sun-light, and Senebier established the fact that the oxygen evolved by plants resulted from the decomposition of the carbon dioxide already taken up from the air, a fact demonstrated in a quantitative way by de Saussure.

Theodore de Saussure of Geneva, son of a famous botanist of the same city was the first to draw attention to the mineral or ash constituents of the plant. He maintained that these ash ingredients were essential and that without them plant-life was impossible. He did experiments to show that plants obtain their carbon from carbon dioxide in the air, under the influence of the sun-light. He was of the opinion that the hydrogen and oxygen of the plant were probably chiefly derived from water. He showed that by far the largest portion of the plant's substance was derived from the air and from water and that the ash portion was alone derived from the soil. His work was published in

1804 in a small volume called *Recherches Chimiques sur la Vegetation*, one of the most fascinating books on the subject ever published. But it met the same fate as many another scientific book ; it was ignored for a long time.

To de Saussure we owe the first definite statement on the different sources of the plant's food.

During the first thirty years or so of the 19th century little advance was made except that two chemists Humphrey Davy in England and von Thaer in Germany were collecting and examining the farmers' knowledge about manuring and putting it into terms that chemists could understand. Towards the middle of the 19th century, however, the subject received more and more attention and great advances were made in our knowledge of plant growth.

J. B. Boussingault, a very able Frenchman, after adventurous travel in South America, settled down on his farm at Bachelbronn in Alsace and commenced about 1835 a series of field experiments in which for the first time the scientific method of measuring all relevant matters was adopted. He weighed and analysed the manures applied and the crops obtained, and at the end of the rotation, drew up a balance sheet showing how far the manure had satisfied the needs of the crop and how far other sources of supply—the air, the rain and the soil—had been drawn upon. These measurements accorded exactly with the work of the plant physiologists and showed that :

(1) "The main part of the crop is composed of carbon, oxygen and hydrogen, most if not all of which comes from the air and from water and not from the organic matter of the soil ;

(2) "The nitrogen of the crop comes largely, if not entirely from the soil or from manure;

(3) "Mineral matter is an essential part of the crop and it comes from the soil or from manure."

Notwithstanding the investigations of those who had preceded him, Justus von Liebig soon became the great central agricultural figure in 1840. Liebig controverted the so called 'humus theory' *viz.*, that the plants obtain the greater part of their substance from the organic matter

of the soil, a view first distinctly taught by Einhof and Thaer about the end of the 18th century and still widely held. And then in treating of the relation of the soil to the plant, Liebig put forward his 'mineral Theory': that if plants are supplied with the small quantity of mineral matter of the ash the remainder of their substance can be drawn from the air. He was the first fully to estimate the enormous importance of the mineral portion of the plant's food and to restate in a more emphatic manner the views of de Saussure on this subject He pointed out that the most important constituents of manures were phosphates and potash, and though at first he also included combined nitrogen, in his later expressions he failed to appreciate the value of nitrogenous manures, holding that a sufficient amount is washed from the atmosphere in the form of ammonia. It appears that Liebig was greatly in error when he expressed the view that combined nitrogen is not an important constituent of manures and that a sufficient amount is washed form the atmosphere in the form of ammonia.

A practical improvement which we owe to Liebig is the manufacture and use of 'dissolved bones' and superphosphates. Bones as a manure began to be used about 1775, it is said, first in Yorkshire, and their value was so much realised by English farmers that they were imported in large quantities from the continent of Europe. Liebig in 1840 discovered that by treatment with sulphuric acid, bones could be greatly improved as a fertilizer, being rendered thereby much quicker in action and, in every way, more efficacious.

Just before this time, John Bennet Lawes, the young squire of Rothamsted had been making a number of experiments to try out the manurial effects of various substances. Observing the young man's tendency to experiment, a neighbouring landowner, Lord Dacre, asked him to try and find out why bones, so useful in other parts of England, were of little value on the Rothamsted and surrounding farms. Some years before this time chemists had been studying the composition of bones and had proved the presence of calcium and phosphorus in the combination known as phosphate. They had also discovered other phosphates of calcium, three in all, of which one was soluble in water and the other

two not. The soluble one called superphosphate of lime could be prepared from the insoluble ones simply by treatment with an acid such as sulphuric or hydrochloric. Lawes knew of these results and he recognised their bearing on Lord Dacre's problem. He knew that the phosphate in bone is insoluble, but can be made soluble by treatment with sulphuric acid, and thought it probable that the soluble phosphate would be more easily taken up by the plant than the insoluble one. He, therefore, tested this 'dissolved bone' in the field and showed that it was an effective fertilizer. The discovery was interesting but not in itself of far reaching importance because bones were dear and would probably always remain so.

But about that time geologists were discovering vast deposits of mineral calcium phosphate for which little use was apparent. Lawes knew from the chemical results that this mineral phosphate, after treatment with sulphuric acid, would give precisely the same soluble phosphate as bones, and he argued that it ought to be as useful as bones, besides being much cheaper and far more abundant. In a barn at Rothamsted that had been converted into a laboratory, a few hundredweights of superphosphate were made from mineral phosphate. This superphosphate was tried on the so-called Barn-field lying just outside and found to be very effective. After further trial but not without some misgiving because the manure trade was not then the kind of thing a gentleman indulged in, Lawes in 1842 took out a patent and set up a factory at Deptford, where superphosphate and other fertilizers were made, and as they were manufactured they were given the name 'artificial fertilizers.'

In another set of pot and field experiments Lawes had shown that sulphate of ammonia increases plant growth. He seems to have tried this material because it could be obtained cheaply from the gas works, there being little demand for it; but he, and still more Gilbert, a former student of Liebig who associated himself with Lawes in 1843, recognised clearly the underlying scientific fact that the sulphate of ammonia contained nitrogen and they showed that the plant benefited by an increased supply.

Their field experiments were on wheat and turnips, then two of the most important crops in England, and they showed that the yield of wheat could be raised from 20 bushels per acre, the customary yield at Rothamsted, to over 30 bushels simply by the addition of a few hundredweights per acre of the cheap superphosphate and sulphate of ammonia. Marked increases were obtained in yields of turnips and, in later experiments, of barley, grass and other crops. The financial results were eminently satisfactory, and progressive farmers quickly took up the new 'artificial fertilizers.'

The new industry was not without its troubles on the scientific side. Lawes soon became involved in a controversy with Liebig, who maintained that plants derive all their nitrogen from the air and need no artificial supply. The Rothamsted field plots showed that Lawes was right, but Liebig remained unconvinced and denounced the Rothamsted experiments in the most scathing terms.

The controversy had at any rate the good result that it led Lawes and Gilbert to continue their field experiments year after year on the same ground to demonstrate the fertilizer value of nitrogenous compounds, and they did this long after Liebig's case was lost. The elaborate experiments conducted at Rothamsted by Lawes, Gilbert and Pugh in 1857 proved conclusively that a supply of combined nitrogen in the soil was absolutely necessary for the successful growth of plants. In fact, in the course of the experiments at Rothamsted in which the soil was sterilized without thought of the consequences, it was concluded that the gain in nitrogen by legumes was due merely to their great feeding range by virtue of sending their roots so deeply into the soil—a conclusion which for several years received world-wide acceptance.

On the practical side there were many farmers and agricultural writers who refused to believe that 'artificial fertilizers' made in a factory and sold in bags could possibly do anything but poison the ground. Wren-Hoskyns described this attitude well: the "smiles, winks, murmurings, shakes of the foreboding head, and other demonstrations, jocular and

serious" when the manure was 'sown'—a ludicrous idea to the old men of the time.

As far as Lawes himself was concerned the times seemed almost desperate. He had to amend his patent and discard bones for it was proved that Liebig had already advised farmers to treat bones with sulphuric acid for the purpose of making them more effective as a fertilizer. Various people set up manufacturing processes that either infringed his amended patent or seriously reduced the value of his monopoly. In 1852, therefore, he began a law suit against them. The law suit must have proved costly; in the end Lawes won on some counts but not on all He straightened matters up, however, by buying out the opponent, who had doubtless found the law suit equally exhausting.

After this came a period of brilliant prosperity, lasting with some ups and downs from about 1855 to 1874. The lessons of the Rothamsted experiments continued year after year, whatever the season and whatever the financial outlook. 'Artificial fertilizers' became firmly established as part of the routine of farm practice, and their manufacture became an important British industry, enjoying good home markets and a substantial export trade. The fertilizer industry, in fact, including also the trade in Chilean nitrate and guano, became to a considerable degree centred in British hands. Other countries have since learned to manufacture superphosphate so that this is no longer a British monopoly, nor is Britain any longer the largest producer; North America, France and Italy, all much exceed British production now.

There was, however, still one point which remained somewhat unintelligible—the gain in combined nitrogen which seemed to take place when certain crops of the leguminous order were grown. Boussingault in his earliest investigations had shown that in certain rotations which included clover or lucern, more nitrogen is removed in the crop than was supplied in the manure, and many of the Rothamsted results could only be explained on the assumption that the roots of such crops ranged exceptionally deep and drew upon stores of subsoil nitrogen unavailable to other plants. It was not until 1886 that these difficulties were cleared by the discovery

of Hellriegel and Wilfarth that leguminous plants fix the atmospheric nitrogen by the help of certain bacteria living in symbiosis upon the root of the leguminous plant. The leguminous plant, however, will also feed upon combined nitrogen in the soil like any other plant, and the failure of Lawes and Gilbert to detect any nitrogen fixation in their laboratory experiments with beans and clover, was due to the great care to shut out any intrusion of foreign matter during the experiments, thus preventing the leguminous plants from being inoculated with the bacteria causing fixation and also due to the fact that in most cases soils were sterilized.

A more recent scientific triumph has been the production of nitrogenous fertilizers from the air. For many years England was the chief producer of these fertilizers, being the largest user of coal, from which sulphate of ammonia was made, and owning the largest interests in the Chile nitrate fields. Extensive as these resources were, it was by no means certain that they could long have continued to satisfy the demand, and in 1898, in his famous address to the British Association, Sir William Crookes took a distinctly pessimistic view. As a man of science he tempered his pessimism by pointing the way out. He showed that an old laboratory experiment made by Cavendish in 1783 and repeated by thousands of chemical students throughout the 19th century without much thought as to its significance, could be turned to the manufacture of 'artificial fertilizers' from the air. The experiment had consisted in the passing of an electric spark through the air, whereby some of the oxygen and nitrogen combined. By the substitution for a large arc for the spark, large quantities of nitrates could be made

The Norwegian chemists and engineers immediately took the matter up, utilizing their cheap water power for the generation of the electricity. The Swedes quickly followed by a different process, due to Caro, which produced calcium cyanamide; this the Italians, the Swiss and the Americans have since developed. Both processes, especially the Norwegian, required considerable power. In Germany the Haber process was devised for effecting the combination of nitrogen and hydrogen at moderately high temperature and pressure. This requires little power, but a high standard of scientific

and technical attainment on the part of the staff; it was developed to a remarkable extent during the war and is now used in Germany by the I.G Farbenindustrie Aktiengesellschaft, the largest producer of synthetic nitrogen compounds in the world. During and since the war a modification of the process was worked out in England, and now Imperial Chemical Industries, Limited, operating at Billingham, near Stockton on Tees, is already the second largest producer of synthetic nitrogen compounds.

In the preceding paragraphs a short account has been given, touching only the salient features of the development of the science of manures, the food of plants, and the manufacture of 'artificial fertilizers.' Since 1840 progress in the different branches of agriculture and especially in the science of manures has been much more rapid, and it has, therefore, been not possible to give a detailed account of the many advances that have been made. In subsequent chapters reference will be made to the discoveries that have been made and the knowledge gained.

References

Aikman, C. M. ... Manures and Manuring

Davy, Sir Humphrey ... Elements of Agricultural Chemistry.

Digby Kenelm ... A Discourse Concerning the Vegetation of Plants.

Hall, A. D. ... The Book of Rothamsted Experiments.

Hall, A. D. ... Fertilizers and Manures.

Harris Joseph ... Talks on Manures.

Ingle, Herbert ... A Manual of Agricultural Chemistry.

Lawes, J B, Gilbert, J., and Pugh, E. ... On the Sources of the Nitrogen of Vegetation, with special reference to the question whether plants assimilate free or combined Nitrogen. Rothamsted Memoirs. Vol. I.

Liebig, Justus von ... Chemistry in its Application to Agriculture and Physiology.

Russell, E. J. ... Soil Conditions and Plant Growth.

Russel, E. J. ... Lond. Min. Agri. Fish Bull 28.

Saussure, Theodore do ... Recherches Chemiques sur la Vegetation.

Tull, Jethro ... Horse-Hoeing Husbandry.

Wheeler, J. H. ... Manures and Fertilizers

Whitney, Milton ... Soil and Civilization.

Woodward. ... Thoughts and Experiments on Vegetation. Phil. Trans. 21

CONVOCATION OF THE HOME-MAKING DEPARTMENT

BY

K. F. A. ABEL

Indeed woman is the maker of a home and the manager of the household And it is not out of place to quote here that: "To-day woman must realise that she is not merely the creator, but also the preserver. She has always been and always will be the helpmate, the co-sharer of man in the evolution of life No nation can improve, except through the improvement of the nation's homes, and these can only be improved through the instrumentality of women"

The Home-Making Department is an integral part of the Allahabad Agricultural Institute. It was started in 1936 primarily with the object of giving proper training to young women in caring for and improving their own homes. But there was also the purpose in mind of training social service workers and teachers who could instruct the students in home-making Home-Making with the English Teachers' Certificate, was given from 1939 to 1943 The new combination of subjects for the Intermediate examination sanctioned by the Board of High School and Intermediate Education, U.P., including two optionals in Home Economics will begin from July, 1943, and the E. T. C. course will cease at the end of the next academic year, 1944.

The annual convocation was held on April 2, 1943, at 6 p.m. at the girls' hostel grounds. Dr Sam Higginbottom, Principal, introduced Mr. J. C. Powell-Price, Director of Public Instruction, who made the convocation address. The D. P. I. said that this branch of teaching was now included in the educational programme and that soon there would be a great demand for qualified women teachers. He also announced an annual grant to the department. Mrs. Sam Higginbottom, founder and head of the Home-Making Department then presented the girls who had qualified for their diplomas to Mrs. A. C. Banerji, who presented the certificates to the girls with a charge. Dr. Higginbottom in his closing remarks thanked the D.P.I., Miss Williams, Chief Inspectress, and other guests for taking the trouble of attending

the function. Finally he quoted from the prophet Joel, "Your old men shall dream dreams, your young men shall see visions". By this he referred to the time of his and Mrs. Higginbottom's retirement to the United States. There he said, they would dream of the work started in the Institute, and it was for the younger generation to see visions of what the future would be. After the function the guests were served with light refreshments.

During the function the following songs were sung by the students:

First

1. We plow a field and sow a seam
And milk a cow just right.
We conquer soils and chemistry
And study with all our might.
For by work and play at the Institute
We are working for India too,
That all her sons and daughters
May live full lives and true.

Chorus:

Agricultural Institute
Greater be thy name.
The land is great and we are small,
Yet may this be our aim;
That as we have been served by you.
We may serve our India too.

2. There's fun and fellowship for all
When the long day's work is through;
And laughter and music oft resound
Across the Jumna blue.
For by work and play at the Institute
Our hearts and minds grow strong,
That as India's sons and daughters
We may join her happy throng.

Chorus: repeated.

Second

The Institute's the Place

The Institute's the place for those
Who love both work and play,
Books and picnics, teas and classes too;
Essays, notebooks, sports and play days,
Friends both old and new,
Songs and talks to end a perfect day.

(*Continued on page* 126)

"HAL"—A REVIEW

By

S. R. Misra

'Hal' is an illustrated monthly agricultural magazine put out by the Rural Development Department, U.P. The Rural Development Officer, U.P., Lucknow, is the chief editor. It is printed and published at the Indian Press, Ltd., Allahabad. The annual subscription is Rs. 5-8 and one copy costs 8 annas.

'Hal' is published in both the vernaculars of the province—Hindi and Urdu. Obviously it is meant for circulation among the rural folks but it is equally useful to other people also who may be interested in agriculture. It is useful for agricultural teachers and students.

The magazine deals with practically all aspects of agriculture and rural life. It contains articles on subjects such as consolidation of agricultural holdings, soil, cultivation, plant life, comparisons of different varieties of crops, crop pests, insecticides, fruit culture, and so on. There are articles also on co-operation, adult education, village sanitation. Articles of an industrial character also find a place. Then there are also reports, both Indian and foreign, illustrated war news, stories, poems, and social topics. It has a number of good pictures.

It is the best agricultural magazine written in the provincial vernaculars that I have seen so far. But I do not know about its circulation. Does it reach those in large numbers for whom the magazine is primarily meant? The magazine seems to have come into existence in January 1939. I doubt if the literate village people would be paying Rs. 5-8 annually in order to get this magazine and benefit by it. I hope it is supplied free to all the village primary schools, panchayat-ghars and such societies and even interested individuals who may be in close touch with the villages.

Most of the contributors seem to be Government officials. While their interest must be kept intact, non-official people should also be increasingly encouraged to contribute. Besides imparting agricultural information the paper is also

serving to build up agricultural literature in vernaculars. Most agriculturally trained people find it easier to write and speak on agriculture in English than in Hindustani. The magazine is a great help to them and so its editor should always keep in view the language of the paper.

I hope the 'Hal' of Lucknow will continue to maintain its progress, and not degenerate later like the 'Kisan' of Fyzabad. The latter was probably the first agricultural paper in the province and had official backing. I have not seen it for some time and so wonder if it is still in existence. The 'Hal' should not develop into a thing of show but continue to be of service.

CONVOCATION OF THE HOME-MAKING DEPARTMENT

(*Continued from page* 24)

Sunsets from the river bund,
Boatrides now and then,
Parties, sing-songs, hostel bells,
Can't come back again.

So we'll do the best we can to make it all remain,
In our hearts to cheer us later on;
May she bring to others what from us will soon be gone,
Making all her friends an endless chain.

Let us do our work as well,
Both the unseen and the seen;
Make the house where gods may dwell,
Beautiful, entire and clean.—*Longfellow.*

The estimated production of tea in India for the year is 555 million pounds.

In order to improve the standard of spinning in the villages, the Egyptian Government got a model of a spinning wheel from the Government of India; and now spinning wheels with certain modifications are being made and will be distributed all over Egypt for use by the cultivators of that country.

UNITED PROVINCES DEPARTMENT OF AGRICULTURE, MONTHLY AGRICULTURAL REPORTS FOR

JANUARY, 1943

I—Season.—Except for the third week which was rainless in some districts, rainfall during the month under report was wide-spread throughout the Province. The total rainfall was above the normal in many districts and proved beneficial to the standing crops.

II—Agricultural operations.—Agricultural operations are up to date. The irrigation of *rabi* crops, crushing of sugarcane, preparation of land for sugarcane and *zaid* crops are in progress.

III—Standing crops and IV—Prospects of the harvest.—The condition of standing crops is satisfactory and prospects of the harvest are on the whole favourable, having been considerably improved by the rain during the month.

V—Damage to crops.—Damage due to hail-storms is reported from the Jhansi, Jaunpur, Ghazipur, Ballia, Azamgarh and Fyzabad districts.

VI—Agricultural stock.—The condition of agricultural stock is on the whole fairly satisfactory, although cattle diseases have been reported from a number of districts. From Table 1, compiled from data supplied by the Director, Veterinary Services, United Provinces, it would appear that there has been a decrease in the number of seizures but an increase in the number of deaths, resulting in a pronounced increase in mortality. In the case of Anthrax, there has been a slight decrease in the number of seizures and deaths but the mortality in both this as well as in the preceding months has been 100 per cent. In the case of Hæmorrhagic Septicæmia, there has been a decrease in the number of seizures and deaths, but a marked increase in mortality. There have been three cases of seizure and death from Blackquarter as against no case of seizure or death during the preceding month. In regard to Rinderpest there has been an increase in the number of seizures as well as of deaths, but a slight decrease

in mortality. There has been a marked decrease in the number of seizures, but a slight increase in the number of deaths, resulting in a slight increase in mortality in the case of Foot and Mouth disease. As regards "other diseases," there has been a pronounced increase in the number of seizures as well as of deaths, the mortality having risen from 0 to 70 per cent.

Table 1.—Number of seizures, deaths and mortality from cattle diseases in December and January, 1943

Diseases	Seizures		Deaths		Mortality	
	December	January	December	January	December	January
Anthrax ..	5	3	5	3	100	100
Hæmorrhagic Septicæmia ..	84	60	70	57	83	95
Blackquarter ..	..	3	..	3	..	100
Rinderpest ..	778	837	437	442	56	53
Foot and Mouth ..	4,220	1,968	11	18	0·26	·92
Other diseases ..	4	60	..	42	..	70
Total ..	5,091	2,931	523	565	10	19

N.B.—Mortality $= \frac{\text{No. of deaths}}{\text{No. of seizures}} \times 100$

VII—Pasturage and fodder.—Pasturage and fodder are reported to be sufficient everywhere except in the Fatehpur, Unao and Hardoi districts where some scarcity is reported.

VIII—Trade and prices.—In Table 2 are given the retail prices of important agricultural commodities in rupees per maund, at the end of the month under review and of the preceding month. From this table it would appear that the prices of all the commodities have, taken as a whole, remained more or less stationary.

Table 2.—Retail prices in rupees per maund of Agricultural commodities for December, 1942 and January, 1943

Commodities	Retail prices	
	December	January
Rice	10·765	10·915
Wheat	8·125	7·955
Barley	6·842	6·409
Gram	7·569	7·743
Arhar	10·849	10·818

IX—Health and labour in rural areas.—The condition of agricultural labour in rural areas has on the whole been satisfactory, although cases of small-pox, plague, cholera, influenza and seasonal fever are reported from some districts.

FEBRUARY, 1943

I—Season.—During the month under report, the first, third and fourth weeks were practically rainless. During the second week, however, light showers were received in most of the districts, but the total rainfall in all the districts was in defect of the normal.

II—Agricultural operations—Agricultural operations are generally up to date. Pressing of sugarcane, irrigation of *rabi* crops, preparation of land for sugarcane and *zaid* crops are in progress. Sowing of sugarcane and *zaid* crops, as also harvesting of wheat, barley, gram, peas and mustard, has commenced in many districts.

III—Standing crops and *IV—Prospects of the harvest.*—The condition of standing crops and prospects of the harvest are on the whole satisfactory. The out-turn of *rabi* crops is roughly estimated to be 80 per cent. of the normal.

V— Damage to crops.—Damage by hail-storms is reported from the Bareilly, Shahjahanpur, Ghazipur, Rae Bareli, Sitapur, Kheri, Fyzabad and Partabgarh districts and by

frost from the Muttra, Jalaun, Sitapur and Bara Banki districts.

VI—Agricultural stock.—The condition of agricultural stock is on the whole satisfactory, although cattle diseases have been reported from a number of districts. From Table 1, compiled from data supplied by the Director, Veterinary Services, United Provinces, it would appear that there has been, since the last month, a pronounced decrease in the total number of seizures and deaths and a slight decrease in mortality. No cases of Anthrax have been reported during the month. As regards Hæmorrhagic Septicæmia, there has been a decrease in the number of seizures and deaths and a slight increase in mortality. In the case of Blackquarter, the number of seizures and deaths, and mortality have remained unaltered. There has been a marked decrease in the number of seizures and deaths from Rinderpest, although a slight increase in mortality. In the case of Foot and Mouth disease there has been a marked decrease in the number of seizures, but a slight increase in the number of deaths, and mortality. As regards "other diseases", there has been a considerable decrease in the number of seizures and deaths, but a marked increase in mortality.

Table 1.—*Number of seizures, deaths and mortality from cattle diseases in January and February*, 1943

Diseases	Seizures		Death		Mortality.	
	January	February	January	February	January	February
Anthrax ..	3	..	3	..	100	..
Hæmorrahagic Septicæmia ..	60	48	57	45	95	94
Blackquarter ..	3	3	3	3	100	100
Rinderpest ..	837	389	442	208	53	54
Foot and Mouth ..	1,968	1,169	18	19	0·92	1·6
Other diseases ..	60	14	42	12	70	86
Total ..	2,931	1,623	565	287	19	18

N.B.—Mortality $= \frac{\text{No. of deaths}}{\text{No. of seizures}} \times 100$

VII—Pasturage and fodder.—Pasturage and fodder are reported to be sufficient everywhere except in the Hamirpur, Unao and Hardoi districts where some scarcity is reported

VIII—Trade and prices.—The retail prices of important agricultural commodities in rupees per maund at the end of the month under report and of the preceding month are shown in Table 2, from which it would appear that the prices, taken as a whole, have risen very slightly.

Table 2—Retail prices in rupees per maund of Agricultural commodities for January and February, 1943

Commodities	Retail prices	
	January	February
Rice	10·915	11·070
Wheat	7·955	8·238
Barley	6·409	6·764
Gram	7·743	7·862
Arhar	10·818	10·932

IX—Health and labour in rural areas.—The condition of agricultural labour in rural areas has been satisfactory, although cases of plague, cholera, small-pox and influenza have been reported from some districts.

Modern dehydration can reduce 80 pounds of peas to 15 pounds in less than ten hours.

The broad nose of the Negro is adapted to breathing air at relatively high temperatures, while the longer, narrow nose of the white is better adapted to low temperatures

REVIEW

THE PRESERVATION NUMBER

(*The* 1942 *Annual Number of the Punjab Fruit Journal*)

Foreword by the Hon'ble Rao Bahadur Ch. Sir Chhotu Ram, Minister for Revenue, Punjab.

Edited by S. B. S. Lal Singh, Fruit Specialist, Punjab, Lyallpur

and

Dr. Girdhari Lal, Bio-Chemist, Fruit Products Laboratories, Lyallpur.

Available from The Punjab P. C. Fruit Development Board, Lyallpur.

"There is an extreme dearth of authentic literature dealing with fruit and vegetable preservation pertaining to Indian conditions, as books written by foreign authors do not fully answer our purpose. There was, consequently, a keen demand for the publication of suitable literature on the subject. And this demand has been still further intensified by the present war inasmuch, as importation of foreign products has almost completely stopped, there is need for local production, and in fact, a rare opportunity to develop this industry when it can have a normal chance of survival without being strangled by foreign competition."

Keeping the above in view, the Punjab Fruit Development Board, which has earned a reputation for bringing authoritative literature on gardening suitable to Indian conditions, has devoted the fifth Annual Number of the Punjab Fruit Journal exclusively to the Fruit and Vegetable Preservation Industry. We congratulate our contemporary in completing its first quinquennium and for establishing itself as a successful venture in horticultural journalism in the East.

This compendium will surely be of immense use to those who are interested in Fruit and Vegetable Preservation and will be welcomed alike by research scholars and commercial magnates.

It is a handy illustrated Annual comprising seventy (70) pages replete with facts essential for starting the Preservation Industry both as a war and post-war measure. Some of the most informative articles in this 'souvenir' are:

Future of Fruit Preservation Industry—War and the Preservation Industry—Facilities for Training in Fruit Preservation—Equipment for a Fruit Preservation Factory—Preparation of Citrus Fruit Squashes and Cordials—Preparation and Preservation of Unfermented Apple Juice—Preparation of Jam from pears and plums—Tomato Ketchup—Tomato Juice—Guava Cheese—Pickling of Vegetables—Drying of Vegetables—Vinegar Manufacture for Home Use—Control of 'Spoilage' in Canned Foods—Summary of the work done in Fruit and Vegetable Preservation at the Fruit Products Laboratories, Lyallpur—Directory of Firms Supplying Fruit Products and Fruits.

This Number is priced at Re. 1-8 including postage on pre-paid Money Order basis or V.P.P. basis; but to regular subscribers of the journal and the members of the Punjab Fruit Development Board, this Number along with other issues of the journal is supplied free. The Annual subscription of the journal is Rs. 3 on pre-paid Money Order basis and Rs. 3-8 per V.P.P. basis.

NOTE:—Popular abridged Urdu Edition of this Special Preservation Number, comprising 40 pages of the reading matter priced at Re. one including postage on pre-paid Money Order basis or V.P.P. basis, is also available for sale.

For further particulars please write to—

THE HONY. SECRETARY,
Punjab P. C. Fruit Development Board, Ltd.
Punjab Agricultural College, Lyallpur (India).

Registered No. A-925

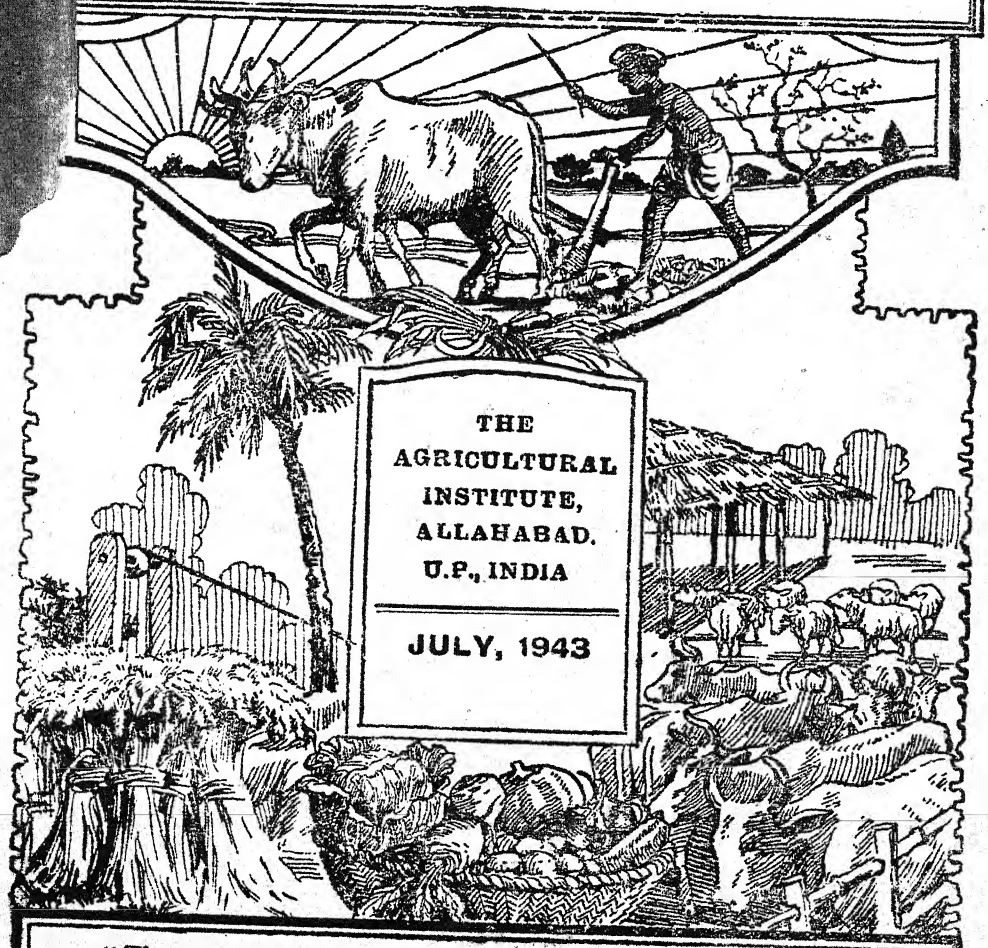
VOL. XVII] [No. 4

THE ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life



THE AGRICULTURAL INSTITUTE, ALLAHABAD. U.P., INDIA

JULY, 1943

"The glory of the farmer is that, in the division of labors, it is his part to create. All trade rests at least on his primitive activity. He stands close to nature; he obtains from the earth the bread and the meat. The food which was not, he causes to be."

—Ralph Waldo Emerson.

Rules for the Award of the Prize for detecting an Effective Pest or Disease on Tokra without endangering Tobacco and other Crops

—:o:—

1. The prize shall be Rs. 3,000 and shall be awarded by the Tobacco Market Committee, Guntur.
2. The prize shall be in cash.
3. The award shall be made under the conditions specified hereunder to the discoverer of a pest or disease on tokra (Orobanche sp.) occurring on tobacco in the Guntur District.
4. The pest or disease shall be injurious to the tokra in such a way that the occurrence of tokra is considerably minimised, if not prevented. The pest or disease should not endanger tobacco or any other crop grown in the Guntur District or adjoining districts.
5. It shall be the concern of the discoverer to demonstrate at his cost successfully for two years the efficacy of the pest or disease discovered on a 5-acre tokra infested plot selected by the Committee.
6. The award of the prize shall be subject to the recommendation of an Expert Committee of Scientists, to which the pest or disease and the results of the demonstration will be submitted for scrutiny.
7. The Tobacco Market Committee reserves the right over the discovered pest, or disease, and the results of demonstration.
8. Papers submitted in this connection shall be the property of the Tobacco Market Committee which reserves to itself the right of publishing all or any of the papers

—:o:—

Rules for the Award of the Prize for Inventing Commercial and Useful Methods for the use of Tokra Plants

1. The prize shall be Rs. 2,000 and shall be awarded by the Tobacco Market Committee, Guntur.
2. The prize shall be in cash.
3. The award shall be made to the inventor of a commercial or domestic use for the tokra calculated to consume tokra in large quantities before the setting of seed. Preference shall be given to the discovery of a commercial use which would encourage any rural or cottage industries, as it will be more desirable in the interest of villages. The method shall prove profitable with a decent margin of profit.
4. It shall be the concern of the inventor to demonstrate at his own cost the method for the utilisation of the tokra in large quantities and the sale of the manufactured product.
5. The inventor may reserve for himself patent rights over the method.
6. The award of the prize shall be subject to the recommendation of an Expert Committee to which the invention and the product thereof shall be submitted for scrutiny.
7. The Tobacco Market Committee reserves to itself the right over the award of the prize and over any papers submitted in this connection whose publication shall be vested in the Tobacco Market Committee, Guntur.

THE ALLAHABAD FARMER

A BI-MONTHLY JOURNAL OF AGRICULTURE
AND RURAL LIFE

The ALLAHABAD FARMER is now approved by the Directors of Public Instruction in the United Provinces, Bengal, Central Provinces, Sind, Assam, Bihar, and Orissa, the Rural Reconstruction Commissioner, Punjab, and by the Director of the Institute of Plant Industry, Indore, and Agricultural Adviser to Rajputana and Central India States, for use in all schools under their jurisdiction.

Subscription Rates

Annual subscription : India, Rs. 3; England, 4 shillings; U.S.A., 1 dollar. Single copies, 10 annas; over five years old, 12 annas. Copies which are not received by subscribers will be supplied free of cost within six months of the month of issue. Thereafter single copy prices will be charged.

Unused portions of subscriptions cannot be refunded.

Advertising Rates

	Rs.	a.	p.
One full page of six numbers	35	0	0
One single full page	7	0	0
One half page of six numbers	20	0	0
One single half page	4	0	0
Page 2 or 3 of cover for six numbers ...	50	0	0
Page 4 of cover for six numbers	70	0	0

Contributions

The ALLAHABAD FARMER is published in the first week of each alternate month commencing with the month of January. Contributors are requested to send in their articles at least one month prior to the next prospective date of publication.

Contributors will receive 15 reprints of the article published and additional copies at cost.

Publisher—The Allahabad Agricultural Institute, Allahabad, U.P. (American Presbyterian Mission).
Printer—The Mission Press, Allahabad, U. P.

Business correspondence should be addressed to the Business Manager, Allahabad Farmer.

The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

Vol. XVII] JULY, 1943 [No. 4

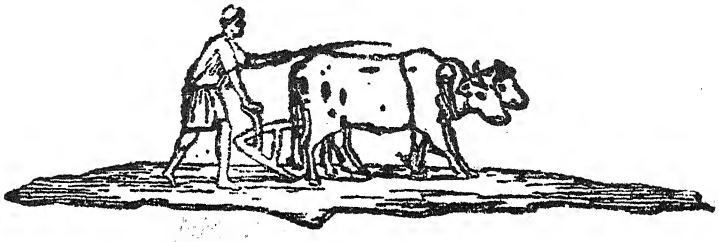
Table of Contents

PAGE

Articles :

THE

ALLAHABAD FARMER



VOL. XVII] JULY, 1943 [No. 4

VARIETAL EXPERIMENTS WITH BARLEY AT THE ALLAHABAD AGRICULTURAL INSTITUTE

BY

B. M. PUGH AND S. C. BHATNAGAR

Agronomy Department,

Allahabad Agricultural Institute.

Introduction.

The United Provinces is the most important barley growing area in this country. Out of a total of about 6½ million acres, sown to barley in the whole of India, this province has an area of about four million acres. In fact this Province produces 66 per cent of India's total production of barley.

Barley is also a major crop of this farm (the Allahabad Agricultural Institute Farm); for, out of a total crop acreage of about 730 crop acres, barley grown mixed with gram, a combination known as *berra*, occupies about 120 acres.

In order to make our contribution to the search for high yielding varieties for the Province as well as for our own

farm; and also for the educational benefit of the students specializing in Agronomy, the Agronomy Department felt that varietal trials with this important crop should be taken up.

Preliminary Trials in 1937-38.

These trials began in 1937-38, when recommended varieties were collected from various parts of the country and sown in our plots for seed multiplication and for preliminary observation so as to be ready for randomized block experiments the following year. The varieties thus chosen for these preliminary trials were C. 251, H 1/92, H. II 134/2, I. P. 21, H. 1/268, T. 20, T. 12, B. R. 1, T. 21, T. 4, H. 24, H. 2, 300A and a local variety. Seeds of these varieties were sown on the 13th November, 1937, in the experimental plot which was an irrigated area. The first observation made was that on flowering. H. 24 and H 1/92 began to flower on the 13th January; that is, exactly two months after sowing. "Local" began to flower on the 16th, 300A and H 1/268 on the 17th, T. 21 and H. II 134 2 on the 18th, T. 12 and C. 251 on the 19th, B. R. 1 on the 20th, T. 20 on the 21st, P. 21 on the 24th and T. 4 and H 2 on the 30th. But of these, H 24, T. 20, C. 251 and B. R. 1 were the first to mature, and so were harvested on the 19th March, whereas H. 1/92, Local, H 1/268, T 21, H. II 134/2, T. 12, I P. 21 and T. 4 were ready for harvesting by the 31st March, and 300A and H. 2 by the 2nd April. It seems, therefore, that H. 24, T. 20, C 251 and B. R. 1 are early maturing varieties, and the other nine are late maturing ones Also whereas C 251, B. R. 1 and T. 20 flowered a week later than H. 24, they matured at the same time with it. This information was considered important for us in Allahabad as it is desirable to have a variety flowering late but maturing early so that it may escape injury during the flowering period when heavy frosts occur early.

Another observation made was on the incidence of rust. Those most affected by rust were H. 24, Local, T. 21, B. R. 1 and C. 251. Those that were moderately affected were T. 12, T. 20, H. 1/268, I. P. 21 and H. 1/92. Those that were slightly affected were 300A and H. II B 4/2.

And those that had only very slight affection were H. 2 and T. 4.

When the crop was harvested the yields of grain and straw for each variety were recorded. The grain yields were as follows: H. 1/92=4·10lbs., C. 251=3·75lbs, T. 20=3·35lbs, 300A=3·00lbs, I P. 21=3·00lbs., T. 12=2·50lbs, Local=2·40lbs., B. R. 1=2·25lbs., H. II 134/2=2·25lbs., H. 1/268=2·00lbs., T. 21=1·30lbs., H. 24=1·25lbs., T. 4=0 25lbs and H. 2=0·25lbs The yields of straw were as follows: H. 1/92=11·45lbs, T. 20=11·25lbs, C. 251=10·55lbs., Local=10·50lbs, I. P. 21=10·45lbs., H. II 134/2=10·01lbs., 300A=8·35lbs., H. 24=7·25lbs., H 2=6·20lbs, T. 4=4 25lbs.

As the result of these preliminary trials in 1937-38 it was decided that only the following varieties be included in a randomized block experiment for the following year: H. 1/92, C. 251, T. 20, I. P. 21, 300A and Local. It will be noticed that the main reasons for the selection of the above varieties is their high yields of grain and straw. And also only the varieties better than the local were retained in addition to Local. The differences in the time of flowering as well as in the time of maturity were not considered important enough to justify the inclusion of those whose yield performances were low. Also while H. 2 and T. 4 appeared to be almost immune to rust they were omitted because their yields of grain and straw were the poorest.

Randomized Block Trials in 1938-39.

In this year a randomized block layout was designed in which each plot consisted of 8 rows, each one foot apart and 52 feet in length. But for purposes of the experiment, in order to eliminate as far as possible the border effects, two feet from each side of the plot was left out as non-experimental. The blocks were replicated six times. The experiment was laid out in an unirrigated area.

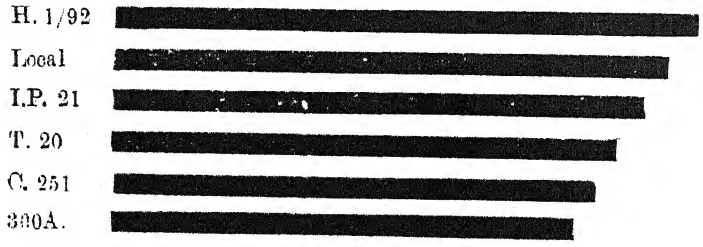
Seeds were sown on the 25th October, the seed rate being 50 lb. per acre.

The first observation made on this experiment was that on germination. As the number of plants in each plot was quite large, we adopted the following method. We made

an estimation of the generation of each row. When the germination in the row was excellent, six marks were given for the row ; when very good five marks ; when good, four ; when fair, three ; when bad, two; and when very bad one. Thus the maximum that any variety in each plot could get was 36, which is a total for 6 r ws, and the maximum marks that a variety could get in the whole layout was 216 These data were analysed statistically and the result was as follows:

H. 1/92	Local	I.P. 21	T 20	C. 251	300A	Significant difference
159	153	142	134	122	114	19

The above may be represented graphically as follows :

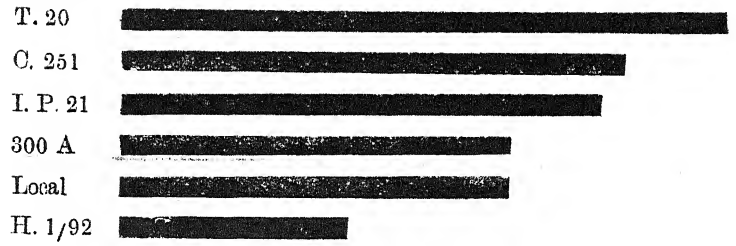


The data show that with respect to germination there was no significant difference among the three best, namely H. 1/92, Local and I.P. 21 Local and P. 21 although of the same class were not significantly superior to T. 20, which again was not significantly superior to C. 251. 300A appeared to be the worst germinator, and was significantly inferior to all the other varieties, except C. 251.

The second observation made was on drought resistance. The amount of rain being somewhat insufficient that year, it appeared that whereas certain plots remained more or less green, other plots showed signs of wilting So estimations were made on each plot on the resistance of the variety as far as could be determined by their appearance, and marks with a maximum of six were assigned to each plot. so that the maximum marks that can be obtained by any variety was 36. The data were analysed, and the results were as follows :

T. 20	C. 251	I. P. 21	300A	Local	H. 1/92.	Significant difference.
32	26	25	20	20	12	2

The above may be represented graphically as follows :

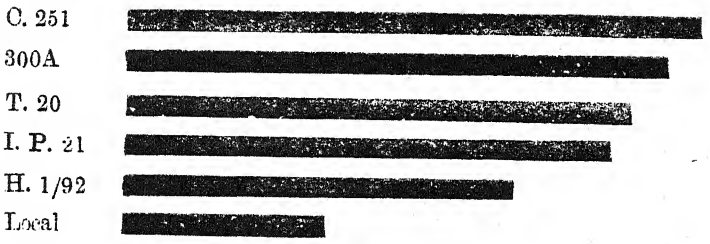


The data show that with respect to drought resistance. T. 20 was the best. C. 251 and I P. 21 were the second best. 300A and Local were in the third class; and H. 1/92 appeared to be the least resistant to drought

Another set of data obtained that year was on the yield of grain of the varieties. The data on analysis gave the following results :

C. 251	300 A	T. 20	I P. 21	H 1/92	Local.	Significant difference.
60·80	56·90	52·60	50·85	40·90	20·05	6·49

This may be represented graphically as follows :

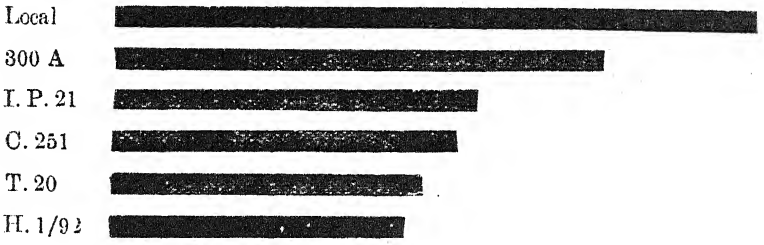


The data show that although the yield of C. 251 was better than 300A, there was no significant difference between the two. C 251, however, was significantly better in yield than the other four, whereas 300A was of the same class also with T. 20 and T 21, although significantly better than H. 1/92 and Local H 1/92 was significantly inferior to the C. 251, 300A, T. 20 and I.P. 21, but significantly better than Local. The Local variety was significantly inferior to all the other varieties.

The data on the yield of straw of the varieties when analysed gave the following results :

Local	300 A	I. P. 21	C 251	T. 20	H 1/92.	Significant difference
81·35	70·15	56·30	55·25	53·41	49·95	12·46

This may also be represented graphically as follows :



The data show that whereas Local gave the highest amount of straw, it did not significantly differ from 300A. And these two were significantly better in the yield of straw than the other four varieties, which were all in the same class statistically.

Randomized Block Trials in 1940-41.

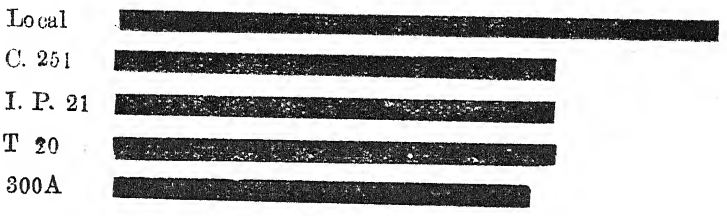
These experiments with barley could not be continued in 1939-40, although the varieties were grown for seed purposes only. But they were continued in 1940-41. And so we now report these varietial trials for the year 1940-4 . In that year a randomized block experiment was laid out with only five of the varieties. H. 1/92 was left out as it was found that sufficient seed of this variety had not been retained for a randomized block experiment.

There were 6 blocks, the plot size being 8'×52', that is eight rows of 52 feet length which were the same dimensions as in 1938-39. The experiment was laid out in a field which was irrigated.

The first observation made that year was on germination. The same method was adopted this year in making these observations as in 1938 39. The data on analysis gave the following results :

Local	C. 251	I. P. 21	T. 20	300A.	Significant difference
31·0	28·0	22·15	22·5	22	2·7

These data may also be represented graphically as follows :

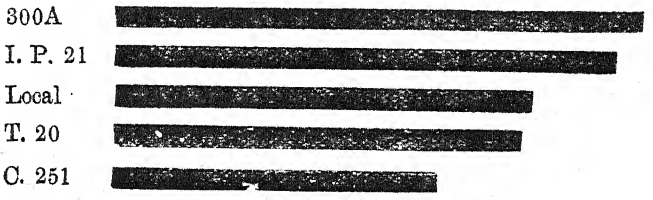


These data show that as far as germination is concerned, Local appeared to be the best germinator and was significantly superior to the others which all came in the same class.

The other set of data taken that year was on the yield of grain. On analysis the data gave the following results:

300A	I. P. 21	Local	T. 20	C. 251	Significant difference
55	53	44	43	35	11

These data may also be represented graphically as follows :

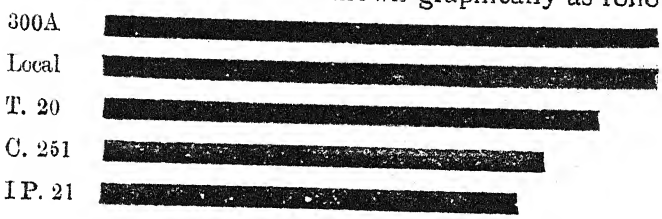


These data show that for that year, 300A and I. P. 21 were the best yielders although I P. 21 did not significantly differ from Local or T. 20. The performance of C. 251 with regard to yield was the worst of the five, although it did not significantly differ from Local or from T. 20.

Another set of data recorded that year was on the yield of straw. These data when analysed gave the following results :

300A	Local.	T. 20	C. 251	I.P. 21	Significant difference.
120	119	107	94	89	21

These data are also shown graphically as follows :



These data show that 300A, Local and T. 20 were in the better group in the production of straw, although Local and T. 20 were not significantly superior to C. 251. T. 20 was also not significantly superior to I. P. 21.

Randomized Block Trials in 1941-42.

In 1941-42 another randomized block experiment was designed and laid out. The number of varieties included in the experiment were 7, that is, to those experimented on in 1940-41, two were again added, namely H. 1/92 and T. 24. The former was one of those included in the preliminary trials of 1937-38 and in 1938-39. T. 24, however, is a new introduction and was originally obtained from the Imperial Agricultural Research Institute, New Delhi, in 1940.

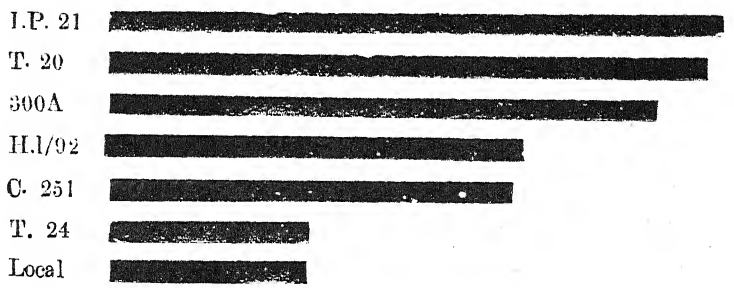
The layout this year again consisted of 6 replications. The blocks were 70′ × 54′, and each plot was 10 × 45′, the number of rows in a plot being 10. And as 2 rows in a plot were left out as non-experimental rows and one foot at the end of each plot, the ultimate size of the experimental plot was 8′ × 52′.

Three observations were recorded this year on the varieties. The first was on rust resistance, the second on the yield of grain and the third was on the yield of straw.

The data on rust when analysed gave the following results :

I P. 21	T. 20	300A	H 1/92	C. 251	T. 24	Local	Signficant difference
32·5	31·5	29 0	22 0	21·0	10·9	10·0	3·5

The data are shown graphically as follows :

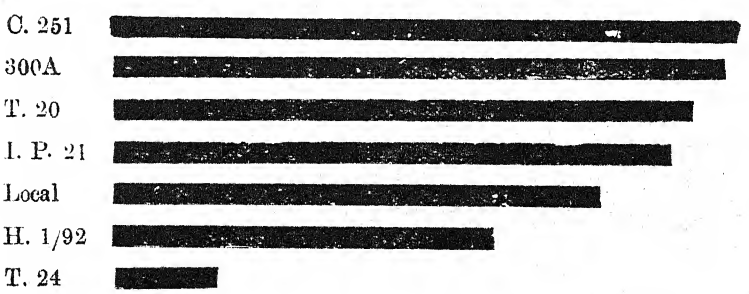


These data show that I.P. 21, T. 20 and 300A were fairly resistant to rust. If the variety had been completely resistant to rust, it would have scored 36, as 6 was the maximum assigned to each plot. H. 1/92 and C. 251 were fairly susceptible to rust, whereas T. 24 and Local were very susceptible.

The data on the yield of grain also gave the following results :

C. 251	300A	T. 20	I.P. 21	Local	H. 1/92	T. 24	Significant difference
98·50	96·50	96·50	87·00	75·50	59·00	15·85	19·09

The results are also represented graphically as follows:

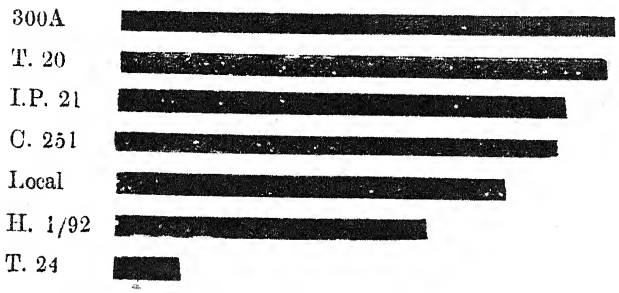


These data show that C. 251, 300A, T. 20 and I. P. 21, were in the best group, although T. 20 and I. P. 21 did not differ significantly from Local. H. 1/92 and T. 24 were the worst yielders, although H. 1/92 was not significantly different from Local.

The data on the yield of straw when analysed gave the following results :

300A	T.20	I.P. 21	C 251	Local	H.1/92	T 24	Significant difference
212·00	210·00	194·50	191·00	167·50	132·50	26·85	28·63

The results are graphically represented as follows :

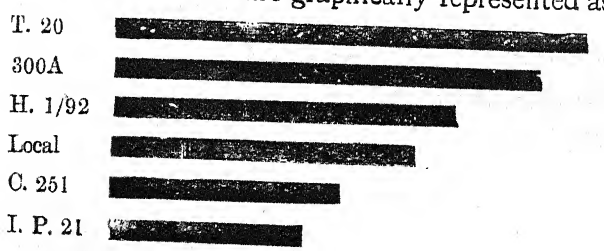


These results show that in the yield of straw 300A, T. 20, I.P. 21 and C. 251 were in the best group, although I.P. 21 and C. 251 were barely significantly different from Local. H. 1/92 was somewhat inferior to Local, but T. 24 was by far the worst yielder.

Finally, in order to ascertain what the local people think of the value of the grains of the above varieties, 10 intelligent cultivators were asked to place the grains of these varieties in their order of merit (T. 24 was omitted in is this estimation of quality because of its very poor yield). These data on grading when analysed statistically gave the following results :

T. 20	300A	H 1 92	Local	C. 251	I. P. 21	Significant difference
50·5	46·0	36 5	32·0	24·5	20·5	10·2

These results are graphically represented as follows:



The results show that in the opinion of the local cultivators T. 20 and 300A possess the best grain character although

the difference between 300A and H. 1/92 seems to be barely significant, whereas H. 1/92 appears to be of the same quality as Local, and Local seems to be superior, although not significantly, to C. 251; and C. 251 in turn is probably superior, but not significantly, to I. P. 21.

Discussion and Conclusion.

From these trials, it appears that for our conditions in Allahabad, the best varieties of barley are C. 251, 300A, I. P. 21 and T. 20.

In respect of yield of grain in the 3 year trials C 251 has proved to be the best under unirrigated conditions and 300A has proved to be a close second; whereas it appears that under irrigated conditions 300A is superior to C. 251. I. P. 21 and T 20 appear to be somewhat inferior to C. 251 and 300A, but their performances have shown that they can be as good as any of the best.

In respect of the yield of straw, 300A appears to be the best of the four, then comes probably T. 20, followed by I. P. 21 and C. 251.

In drought resistance, it appears that T. 20 is the best followed by C. 251 and I P. 21. Then comes 300A

In respect of the germinating quality, the four varieties seem to be about the same with probably some superiority for C. 251 and I. P. 21.

In grain quality as far as is assessed by cultivators T. 20 and 300A seem to be in a superior class to I P. 21 and C. 251.

When the market value of the grain and the straw together was worked out under prevailing prices, we find that 300A is somewhat superior to the other three.

From the above results, therefore, it would appear that we here on this farm as well as in this locality, will not make a mistake, if we adopt 300A or C. 251, a variety recommended by the U.P. Department of Agriculture, as improved varieties.

We feel that our results would have been more complete if we were able to test the malting and eating qualities of the barleys.

Acknowledgment.

This work which we have reported in this paper was done with the help of the students specializing in Agronomy' primarily for their training and education.

MANURES AND MANURING

By

Sudhir Chowdhury

CHAPTER II

Introduction

The term 'manure' originally had a much wider significance than it has to-day. Originally manures were supposed to pulverize the soil, and the French word *manaeuvrer*, from which the word manure comes, implies to work with the hand On this account in bygone days, tillage and manure were synonymous terms, as exemplified by the statement of the historic English farmer Jethro Tull, who, about the year 1700 made the statement 'tillage is manure'. This idea probably originated through the observation that farm manures, which were the only manures in use at that time made the soil less cloddy. However, the term manure gradually came to be applied to any material, with the exception of water, which when it is added to the soil, makes the soil more productive and promotes the growth of plants. There are several ways in which manures applied to soils may increase plant growth :

1. By addition of the nutrient materials utilized by plants, which is the chief function of most of the special manures;

2. By improvement of the physical condition of a soil, which usually results from the application of lime and the incorporation of organic matter ;

3. By favouring the action of useful bacteria, which is one of the beneficial results of farm manures and also of lime ;

4. By counteracting the effects of toxic substances as for instance, the conversion of sodium carbonate into sulfate by gypsum, or the neutralization of acidity, or possibly the destruction of toxic organic substances by certain salts ;

5 By catalytic action, either on chemical processes in the soil or by its influence on those bacteria that exert a favourable influence on soil fertility or by direct stimulation of the plant.

Plant-food Elements:

In describing the relation of manures to crop production, the fundamental considerations are, what are the plant-food elements and what are the sources and supply of these elements. Ten elements are usually considered as absolutely necessary for plant growth. They are carbon, oxygen, hydrogen, nitrogen, phosphorus, potassium, calcium, magnesium, iron and sulphur. Other elements *e.g.* boron, chlorine, copper, iodine, manganese, silicon, sodium and zinc are sometimes found, their presence in the plant being due to special conditions under which it is grown.

The immediate sources from which the plant draws its food elements are the soil and air. Carbon is supplied wholly from the carbon dioxide of the air; while oxygen comes directly from the atmosphere or from water, which is also the source of at least a part of the hydrogen utilized in vegetative growth. The other elements except nitrogen in the case of legumes, which plants, under certain conditions are able to appropriate their nitrogen from the atmosphere, wholly or in part, are derived entirely from the compounds of the soil

When we come to consider the soil we find that there are several sources of loss and gain of plant-food.

Sources of Loss:

1. *The Production of Crops*—As already stated, the constituents of plants, with the exception of carbon and more or less nitrogen in the case of the legumes, are drawn entirely from the soil. The available soil supply, therefore, is depleted by the amount of such constituents which are removed in the crop In a system of farming that involves the sale of the crops as such, the amount and composition of the crops measure the loss of the plant food to the farmer. When, however, crops are fed to animals and the resulting manures are applied to the soil, only a minor part of the commercially valuable materials used for plant growth are actually lost from the farm. The following table gives the quantities of the primary elements for plant growth that are removed from the soil by some of the more prominent farm crops.

Pounds of Nitrogen, Phosphoric Acid and Potash in 100 lbs. of Various Crops.

	Nitrogen	Phosphoric Acid	Potash
Corn fodder (green) ...	0·41	0·15	0·33
Corn fodder (dry) ...	1·76	0·54	0·89
Corn stover	1·04	0·29	1·40
Red top (dry) ...	1·15	0·36	1·02
Timothy (dry) ...	1·26	0·53	0 90
Red clover (dry) ...	2·07	0·38	2·20
Alfalfa (dry)... ...	2·19	0·51	1·68
Barley straw ...	1·31	0·30	2·09
Wheat straw ...	0 59	0·12	0·51
Oat straw	0·62	0·20	1·24
Potato tubers ...	0·21	0 07	0 29
Sugar Beets	0·22	0·10	0·48
Mangel-wurzels ...	0·19	0·09	0·38
Corn Kernels... ...	1·82	0·70	0·40
Barley (grain) ...	1·51	0·79	0·48
Oats (grain)	2·06	0·82	0·62
Winter wheat (grain) ...	2·36	0·39	0·61
Rye (grain)	1·78	0·82	0·54
Buck wheat (grain) ...	1·44	0·44	0·21

2. *Loss by Drainage*:—When the amount of rain water is in excess of the amount which the soil will hold plus that which is given back to the air through evaporation and transpiration by plants, drainage occurs Drainage water always contains more or less of the compounds that serve as plant food. The most important of these is nitrogen in the form of nitrates. In determinations made by Lawes and Gilbert, the quantity of nitrogen as nitrates annually removed in drainage waters varied from 31 8 to 57 9 pounds per acre. This loss is greatest in years of excessive rainfall and is larger from uncropped than from cropped land. The loss is increased by heavy applications of nitrogenous manures, especially of nitrates and ammonia salts. The proportions of phosphoric acid and potash in drainage water are very small indeed, the loss in this way being unimportant.

3 *Loss from Fermentations*:—It has been clearly shown that under certain conditions, especially when the soil contains large amounts of organic matter, without proper aeration, fermentations may occur which cause the loss of nitrogen from the soil in the free form The extent to which such loss occurs under ordinary conditions has never been quantitatively estimated

Sources of Gain:

1. *Manures*:—The application of all farm manures and of all substances usually classed as manures, adds to the supply of the soil compounds which serve as plant food, the quantity of such additions depending on the composition and amount of manures used.

2. *Rainfall*:—The precipitation of water, whether as rain or dew, brings to the soil certain compounds which are washed out of the atmosphere, the most important of these from the standpoint of plant growth being nitric acid and ammonia. Observations made at Rothamsted in the years 1853 to 1856 show that the amount of nitrogen thus conveyed to the soil varied from 5·9 to 8 pounds per acre. Other observers have found the quantity to be as high as 11 pounds per acre.

3. *Fixation of Atmospheric Nitrogen through the action of minute forms of vegetable life*:—It has been shown beyond question that certain forms of bacteria whose life is associated with leguminous plants, have the power of enabling the host plant to acquire atmospheric nitrogen. To the extent that the substance of these plants remains in the soil and decays this action increases the supply of soil nitrogen Other observations indicate that certain species of bacteria cause the fixation of the atmospheric nitrogen directly in the soil, and evidence exists which appears to indicate that some of the lower fungi are similarly endowed.

4. *Supply of Plant-food from the deep layers of the soil*:—The movements of soil water cause more or less transference of soil compounds from one layer of soil to another. This movement is sometimes upward and sometimes downward. During that part of the year when the

rainfall is scanty and the movement of the soil water is almost entirely to the surface, there is unquestionably a transference of some soluble matters from the deeper to the upper layers of the soil. In view of the fact this occurs generally during the season when crops are making active growth, this is a matter of considerable importance. It is not possible to know, of course, the extent to which the upper layers of the soil, in which the roots of the plant are most active, have their plant food supply reinforced from the deeper layers.

The Balance of Plant-food supply and the availability of the food: – It is evident from the foregoing that there are constantly going on, through various causes, losses and gains of the supply of available compounds which serve as food for plants To what extent the store of plant food is being diminished or increased in general or particular localities, it is not possible to estimate Nitrogen is constantly in circulation from the air to the soil, from the soil to the plant, to drainage-waters and to the air, and from the plant and air back again to the soil. But just what proportion of loss or gain occurs of the forms of nitrogen that are available to the plant, it is impossible to state. Any definite figures on the point must be regarded as largely speculative.

When we consider the constituents of the soil we find that they exist in great store. Analyses at the New York Agricultural Experiment Station of samples of soils taken from nine localities in the State of New York, show that the soils which these samples represent contain on one acre to the depth of one foot, 1900 to 7260 pounds of nitrogen, 2400 to 4800 pounds of phosphoric acid and 5400 to 57500 pounds of potash; this calculation being made on the assumption that the air dry soil on one acre to the depth of one foot would weigh three million pounds. It is evident that these quantities represent, if entirely utilized, what would be sufficient for the production of crops during a long series of years. We are not in a position to know, however, the rate at which these quantities of compounds in the upper layers of soil are diminished, if diminished at all, under the usual systems of farm management. It is certainly true that large areas of land when managed in accordance with what are

regarded as correct practices have continued to grow undiminished and luxuriant crops during a long series of years.

Roughly speaking an average soil contains enough plant food for a hundred full crops, yet without fresh additions of plant food as manures the production will shrink in a very few years to one third or one-fourth of the average full crop. Once, however, the yield has reached this lower level, it will remain for an indefinite period comparatively stationary, affected only by the fluctuations due to season. At Rothamsted, for example, wheat has been grown year after year on the same land for sixty-five seasons, and one plot has received no manure throughout the whole period. In the first few years the crop declined steadily, but since then little or no further drop has been seen. The yield remains at about 750 pounds per acre for each successive ten years' average, and has considerably overtopped that amount during recent favourable seasons. This yield, however, of 750 pounds of corn per acre is only about a third of that obtained on the adjacent plots receiving manure every year during the same period.

These facts lead to a new point of view: it is not merely the amount of this or that plant food present in the soil which must be taken into account but also their mode of combination. The material may be present in the soil but yet may be beyond the reach of the plant in a locked-up or dormant condition. The plant can only obtain substances which have been previously dissolved in the water contained by soils in the field, hence plant food in the soil is only available for the plant in so far as it can pass into solution.

Accepting, then, the fact that the soil contains a vast store of all the elements necessary to its nutrition but in forms of low availability, it remains to ascertain which of the elements are normally likely to fall below the current requirements of the crop. This is a question that can only be solved by field experiments, and though the answer will vary with each crop and each soil, yet certain general principles at once become evident and upon them the whole idea of a manure is based. For example, field experiments at once show that certain elements indispensable to the plant as seen from water-culture experiments, need

not be supplied to the crop in the field, since the soil is practically always able to provide a sufficiency. To judge by field experiments alone there are only three elements required for the nutrition of the crop – nitrogen, phosphorus, and potassium—and this means that soils can usually supply the elements necessary to the plant in sufficient quantities except in these three cases. Calcium, while necessary in large quantities in a soil, is largely an amendment, and very seldom may limit plant growth because of being in too minute quantity to supply the food needs of a crop. The liming of a soil is for other purposes than the supplying of calcium for plant nutrition. Manures, then, are usually designed to supply deficiencies in the soil, and for all practical purposes are to be regarded as consisting of compounds of nitrogen, phosphoric acid, and potash either singly or together. They may also contain other plant food elements *e.g.*, magnesium, calcium, sulphur, iron etc, but these though equally necessary to the plant are not counted, since the unaided soil may be trusted to furnish the crop with them.

To summarise the position we have reached: a manure must contain one or more of the three elements, nitrogen, phosphorus and potash, which alone among the various elements necessary to the nutrition of the plant cannot be supplied by cultivated soils in amounts sufficient for profitable crop production. The soils do contain these substances in comparatively enormous quantities but the distinguishing feature of a manure which makes it effective when supplied in quantities comparable with those removed by the crop, is its 'availability'.

Terminology :

In all text-books on the subject the term 'manure' and 'fertilizer' are very often used indiscriminately. It is not possible to make a very clear distinction between the two terms. Hall remarks "Farmyard manure is the typical manure; marl or chalk would no longer be regarded as manure because they do not feed the plant directly; while substances like basic slag or nitrate of soda which simply

supply one or other element in the nutrition of a plant should be termed 'fertilizers' rather than artificial manures. The distinction is not, however, clearly drawn, and manure and fertilizer are generally and unconsciously used as interchangeable terms". According to Parish and Ogilvie. "The word 'fertilizer' may be regarded as the modern word for manure. It is one which has been largely adopted in America."

Literally, however, the terms 'manure' and 'fertilizer' are synonymous and are generally applied to all substances, which are added to the soil in order to increase its productiveness or to restore the natural productive power lost by repeated cropping. But sometimes, however, a technical difference is made and the term 'manure' is applied to bulky materials, generally made from the farm refuses and by-products and 'fertilizer' to substances that have been chemically prepared, are much lighter in form, effective more quickly and usually commodities of extensive commerce Besides, a functional difference is also often made and the term 'manure' is applied to materials which in addition to supplying nitrogen, phosphorus and potassium supplies organic matter and many other elements such as calcium, magnesium, iron, sulphur, etc., and 'fertilizer' to substances which supply any one are all the three essential elements—nitrogen, phosphorus, and potassium. In this treatise, however, the terms 'manure' and 'fertilizer' will be used as interchangeable terms.

Classes of Manures :

Manures are variously classified and in almost all cases in a somewhat loose manner. Sometimes manures are classified into natural manures, artificial manures and mineral manures. "By natural manures are usually meant those produced on the farm itself ; they consist mainly of the remains of plants and animals. By artificial manures are indicated products as are the results of some manufacturing process *e.g.*, sulphate of ammonia, superphosphate, and basic slag. But practically speaking any concentrated fertilizer that is brought on to the farm in bags though

its origin be as natural as the sea birds' excrement 'guano' or the ground seeds known as 'rape dust' gets called an artificial manure in contradistinction to the farmyard manure which is the normal product of the farm". By mineral manures are distinguished such substances as are found in the ash of a plant—the phosphates, the sulphates, and chlorides of the alkalies or alkaline earths; "the compounds containing nitrogen are regarded distinct, since they are ultimately of organic origin, even when they consist of such obviously mineral substances as nitrate of soda or chloride of ammonia. The term 'cinereals' has also been proposed in place of mineral manures or ash constituents".

A second classification is into – single and compound manures. By single manures are meant fertilizers which contain only one ingredient of value to the plant; the compound manures are those which contain two or more fertilizing ingredients. The compound manures are further divided, according to this classification, into nitrogenous, phosphatic and potassic manures according to the elements which predominate.

A third method divides manures into two classes—complete and incomplete manures A complete manure is one which contains every ingredient in which a soil is likely to be deficient. An incomplete manure contains one or more, but not all of the necessary manurial ingredients.

A fourth method treats manures under three heads—organic or natural manures, inorganic manures or fertilizers, and indirect fertilizers. By organic or natural manures are meant substances composed of the remains of vegetable and animal substances. Inorganic manures or fertilizers are those which are of mineral or chemical origin. Indirect fertilizers are those which help plant growth indirectly by accelerating physical, chemical or biological changes in the soil.

A fifth classification is into natural and artificial manures. "By natural manures are usually meant those

produced on the farm itself; they consist mainly of the remains of plants and animals. By artificial manures are indicated products either derived from mineral deposits or manufactured in the arts, though the term is often extended to substances of animal or vegetable origin which are not produced on the farm."

A sixth classification is into .... general manures and special manures. "A general manure is one which contains all the necessary constituents of plant food and thus imparts to the soil to which it is applied a complete store of the nutriment required for fertility" "A special manure contains only one or two constituents of plant food, and cannot therefore supply all the requirements of the plants."

From a critical consideration of all these classifications it will be evident that none of these classifications is satisfactory. Manures are very numerous as to kind and a certain manure may have a number of distinct functions.....this makes any scientific and strict classification of manures extremely difficult, nay, almost impossible. In this treatise however, manures will be treated under the following heads:

I. General Manures.—A general manure is one which contains all the necessary constituents of plant food and thus imparts to the soil to which it is applied a complete store of the nutriment required for fertility *e.g.*, farm manures, green manures, night soil, sea-weed and water hyacinth, guano, fish, crab, lobster and similar wastes.

II Special Manures.—A special manure contains only one or two constituents of plant food and cannot, therefore, supply all the requirements of the plants. They are further divided into nitrogenous, phosphatic and potassic manures according to the single fertilizing material which they contain or which predominate in their constitution. Nitrogenous manures are further dealt under two heads *inorganic* and *organic* according to the form of combination in which the nitrogen is held in the manure.

III. Catalytic Manures.—A catalytic manure is one which when added to a soil increases plant growth by apparently accelerating the processes that normally take place in soils.

IV. Indirect Manures.—An indirect manure is one which when added to the soil help plant growth indirectly by accelerating physical, chemical or biological changes in the soil.

REFERENCES.

Aikman, C. M.	... Manures and Manuring.
Bailey, L. H.	... Cyclopedia of American Agriculture, Vol. I.
Bear, Firman E.	... Theory and Practice in the use of Fertilizers.
Gustafson, A. F.	... Handbook of Fertilizers.
Hall, A. D.	Fertilizers and Manures.
Hall, A. D.	... The Feeding of Crops and Stock.
Hopkins, C. G.	... Soil Fertility and Permanent Agriculture.
Ingle Herbert	... A Manual of Agricultural Chemistry.
Lyon, T.L., Fippin, E, and Buckman, O. H.	Soils: Their Properties and Management.
Parrish, P and Ogilvie	Artificial Fertilizers . . Their Chemistry Manufacture and Application.
Van Slyke, L. L	... Fertilizers and Crops.
Worthen, L. E.	... Farm Soils: Their Management and Fertilization.

Sunflower seeds are substituting in Germany for peanuts and chewing gum, as a confection.

GHEE AND METHODS FOR DETECTION OF ITS ADULTERATION.

By

P. K. Bhargava, B. Sc., B. Sc. Agr.

"It is estimated that ghee accounts for 53 per cent of the total milk produced in India or 77 per cent of the milk used for the manufacture of milk products (which is 69 per cent of the total production). The weight of ghee produced annually is 227·5 lakhs of maunds, valued at Rs. 100 crores. This is on the basis of 16 lbs. of milk giving 1 lb. of ghee. The approximate price realised as ghee is Rs. 2·12 per maund of milk, or Rs. 44 per maund of ghee. Ghee is thus the most important dairy product in India, just as butter is in Western countries." Dr. W. L. Davies.

Ghee is essentially butter fat prepared from the milk of the cow or the buffalo, or from both. It is actually not in quite the original condition in which the fat was found in the milk, owing to slight changes which had taken place during the lactic fermentation of the milk and the other processes in the clarification of the ghee.

Climate has been considered to be one of the main reasons for the production of butter fat in the form of ghee. The climate of India is not suitable for the storage of butter while ghee keeps quite well. Thus butter is turned into ghee or ghee is directly made from milk, so that it may be kept for a longer period before use. For this reason ghee rather than butter has become the principal constituent of food all over India.

The demand is more than the amount produced, and consequently businessmen dealing with ghee have been tempted to manufacture substitutes. When these substitutes are manufactured in large quantities their cost of production is found to be cheaper than that of pure ghee. Dishonest dealers therefore mix these cheaper substitutes with pure ghee and sell the mixed product under the name of "pure ghee."

This has led to the extensive adulteration of ghee and is widely practiced today.

Various measures have been adopted to control adulteration and legislation enacted, but at best these measures have been only partially succesful in putting a stop to this bad practice. The fact is that the detection of adulteration is in many cases quite difficult even for the expert. The task of the analyst has been rendered more difficult by the appearance on the market of on article which goes under the name of "Vegetable Ghee"

In India butter and ghee are chiefly made from the milk of buffalo and cows, and very rarely from that of goats and sheep. The important physical and chemical characters of butter fat and of ghee from the same source have been found to be nearly the same. Owing to the variations in the composition of butter and ghee, which depend upon the breed of the animal, the season, and the kind and the quantity of food supplied to the animal and also on the idiosyncrasy of the latter, it is not possible by merely carrying out so called rapid tests to detect in every case an admixture of foreign fat especially when the quantity is small.

Before going further into the subject we should know what the main adulterants available for the adulteration of ghee are. The following are some of the most common adulterants used in northern India:—

1. Hydrogenated vegetable oils (vegetable ghee).
2. Ground-nut oil.
3. Mahua oil.
4. Coconut oil.
5. Cotton-seed oil.
6. Sesame oil.

} Vegetable oil adulterants.

7. Lard (hog fat).
8. Mutton tallow.

} Animal fat adulterants.

It has been been observed that vegetable adulterants are more frequently used while animal fat adulterants are much less frequently used for adulteration particularly in villages, the home of ghee. The reason for the relatively small use

of animal fats in the villages is that most of the manufacturers of ghee are Ahirs and Gualas who are generally orthodox Hindus and who hesitate to handle or deal with animal products.

In normal times the rate of the pure ghee or "Agmark" ghee has been Rs. 60 to 80 per maund, while the rate of vegetable ghee or hydrogenated oil was around Rs 16 per maund. If a dishonest dealer were to adulterate the pure ghee with an adulterant like vegetable ghee, he may make a profit of Rs. 17 to 34 per maund. This amount is very tempting for a dishonest businessman and thus this becomes one of the main reasons for the adulteration of ghee. Now it has become a very common practice which always keeps busy all the three interested parties, namely the mixer or the dealer, the consumer and the doctor.

Methods of Detection.—Government is taking such measures as it can to stop these bad practices, and chemists have been busy in developing simpler tests for the detection of adulterants.

A common test which is generally employed by every consumer at the time of purchase of ghee is to dip the finger in the ghee and to rub it on the back of the hand for a few minutes and then to smell it. If the flavour or the smell is acceptable to the person he usually decides that the ghee is pure, but if the odour is poor or there is little smell (though the ghee is pure) he might suspect it of being adulterated. Such tests are not sufficiently reliable to judge the purity of ghee, as adulterants are now being supplied with artificial ghee odour and sometimes pure ghee has very little natural odour. The following are the most important and common Quantitative and Qualitative methods for the detection of adulteration in ghee used by the chemist for a scientific appraisal of purity.

1. Refractive Index Value.
2. Reichert—Meissl Number.
3. Polenske Value.
4. Kirschner Value.
5. Iodine Value.

6. Saponification Value.
7. Phytosterol Acetate Test.
8. Flourescence Test.
9. A and B Values.
10. Melting and Solidifying Points
11. Precipitation Methods (Sterol Solubility Tests).

Refractive Index Test:

The refractive index is a measure of deviation of a ray of light when it passes from one medium to another.

The experiment itself is very simple but the apparatus, especially the refractometer, is very costly, and only a few laboratories are equipped with it.

Procedure :—Open the prism casing of the refractometer by turning the milled head half a turn, clean the prism and the metal surfaces carefully with a soft piece of clean linen dipped in the alcohol and the ether mixture. Then place a drop or two of the clear melted and well mixed butter fat (ghee) on the surface of the rinsed prism by means of a glass rod, and close the prism casing by carefully turning back the milled head a half turn.

Adjust the eye piece so that the scale can be distinctly seen, allow a minute or two for the film of fat to attain the correct temperature of 40°C. after which the scale reading is taken in the following manner. Read off the scale figure for the Border line in whole numbers. Ascertain the nearest decimal place by moving the lower ring until the border line just coincides with a full number mark of the scale. The figure indicated by the index of the graduation of the ring would give the first decimal place to be added to the whole number.

In case the refractive index of butterfat is taken at a temperature slightly above or below 40°C. make a correction by adding or substracting from the observed scale reading 0·55 scale divisions for each degree C. according as the temperature is higher or lower.

Precautions:—1. Air bubbles within the stratum of oil or fat must be avoided.

2. The temperature of 40°C, must be maintained throughout the experiment.

Reichert-Meissl Number.

This is the most reliable and common test and is carried out in each and every laboratory where adulteration in ghee is detected. I shall therefore describe this test in detail.

The Reichert-Meissl Number is a measure of the lower soluble volatile fatty acids evolved from 5 grams of butterfat. It should have standard apparatus according to definite specification.

Apparatus and solutions required:—Glycerol, Conc. NaOH solution 50 per cent by weight (1 : 1), Dil. H_2SO_4 (25 c.c. : 1 litre of water) adjusted until 40 c.c. neutralises 2 c.c. of NaOH, Pumice powder, Phenolphthalene solution 10·5 grams dissolved in 10 c.c. of Industrial methylated spirit, Alcohol, N/10 NaOH solution, Silver sulphate powder, 100 c c. graduated cylinder, 50 c c. pipette and Reichert-Meissl apparatus (of accurate dimensions).

Procedure:—Liquify the given sample of butterfat and filter it if necessary. Exposure of the warm fat to the air should be as short as possible. Weigh 5 grams of fat into a Polenske Flask. Add 20 gms. of glycerol and 2 c.c. of NaOH (conc soln.) (the burette containing the soda soln. must be protected from CO_2 and before withdrawal of the solution for tests, the muzzle must be wiped out from carbonate, and the first few drops should be rejected)

Heat over a naked flame with continuous mixing, until the fat including the drops adhering to the upper parts of the flask is saponified, and the liquid becomes perfectly clear. Cover the mouth of the flask with a watch glass.

Make blank test without fat, but using the same quantity of reagents and following the same procedure.

Measure 93 c.c. of boiling distilled water which has been vigorously boiled for 15 minutes. When the soap is

sufficiently cool to permit addition of the water, and before the soap has solidified, add the water to the flask. Dissolve the soap completely by shaking the flask.

If the solution is not clear (indicating incomplete saponification) or is darker than light yellow (indicating over heating), the saponification must be repeated on the fresh samples of the butterfat.

When the saponification is correctly done, then add 0 1 gms. of powdered pumice stone or 5 to 6 glass beads followed by 50 c.c. of the dilute H_2 SO_4 and connect the flask at once with the distilling apparatus. Heat the flask without boiling until insoluble acids are completely melted, then increase the flame and distill 110 c c., in 19 to 21 minutes. The flow of water in the condenser must be sufficient to keep the temperature between 18° to 23°C. When the distillate reaches the 110 c.c. mark remove the flame and replace the 110 c c. flask by a cylinder of about 25 c.c. capacity to catch the drainings

Close the 110 c.c. flask with a rubber stopper and without mixing place it in water at 15 C. for 10 minutes so as to immerse the 110 c.c. mark. Remove the flask from the water, dry the outside and invert the flask carefully avoiding the wetting of the stopper with insoluble acids Mix the distillate by 4 to 5 double inversions with violent shaking, filter through a dry 9 cm No. 4 Whatman filter paper which fits strongly into the funnel. Reject the first runnings and collect 100 c.c. in a dry flask, cork the flask and retain the filtrate for titration as for Polenske value below. The filtrate must be free from insoluble fatty acids.

Detach the distill head and wash the condenser with three successive 15 c c. portions of cold water (distilled), passing each washing separately through the cylinder. Now discard the washings.

Dissolve the insolubles acids by three similar washings of the condenser, the cylinder, and the filter with 15 c.c. of neutralised alcohol, collecting the solution in the 110 c c flask and draining the alcohol after each washing. Cork the flask and retain the solution as at "P" below.

(R) R. M. Value

Pour 100 c.c., of the filtrate containing the soluble-volatile acids into a titration flask and add 0·1 c.c. of solution of phenol phthalein and titrate with N/10 NaOH until the liquid becomes pink, and rinsing the 100 c.c., flask with the nearly neutralised liquid towards the end of the titration. (If the Kirschner Value is to be obtained the titration flask must be dry before use. Note the actual volume of NaOH used Drain the 100 c c., flask into the titration flask close it with a cork and continue as for Kirschner's value below.

If the amounts of NaOH used for the titration of the sample and the blank are equivalent to X c.c. and Xb. c.c. N/10 respectively. Then $R = (X - Xb) \times \frac{110}{100}$.

Polenske Value.

It is a measure of the lower volatile insoluble fatty acids evolved from five grammes of fat and is represented by the number of c.c's. of N/10 alkali required to neutralise the above acid.

Procedure:—Titrate the alcoholic solution of the insolube volatile acids after the addition of 0·25 c.c, of phenol-phthalein solution with N/10 Barium or Sodium hydroxides solutions until the solution becomes pink. If the amount of NaOH used for the titration of the sample and the blank are equivalent to Y and Yb c.c. N/10 respectively, then the Polenske Value = (Y − Yb).

Kirschner's Value.

Add 0·5 grams of finely powdered silver sulphate to the neutralised solution from the R.M. as mentioned above, and allow the flask to stand in the dark for one hour with occasional shakings, then filter the contents through the dry filter paper. Transfer 100 c.c of the filtrate to a dry Polenske Flask, add 35 c.c. of cold distilled water and 10 c.c. of dilute sulphuric acid and a loosely wound 5 m.m. coil of 30 cm. of aluminum wire, and 0·01 gramme of

pumic stone powder. Connect the flask with the standard distilling apparatus and repeat the process as described above; *i.e.*, distill 110 c.c. between 19 to 21 minutes, mixing but without cooling for 10 minutes with the filtration and the titration of 100 c c. of filtrate with N/10 NaOH.

If the amounts of NaOH used for the titration of the fat and the blank are equivalent to Z c.c, and Zb c.c., of N/10 respectively, then the Kirschner's value = $(Z - Zb) \times \frac{(100+A) \times 121}{10,000}$, where "A" is the actual volume in c c. of the NaOH solution used in titration for determination of the Reichert value.

Iodine Number.

The iodine absorption number is the percentage of halogen expressed as Iodine, absorbed by the fat or oil when subjected to the action of a halogen solution under specified conditions. The absorption takes place because of the presence of glycerides of unsaturated acids, which contain double or triple bonded carbon atoms.

Procedure:—Half fill a 20 cc. weighing bottle with melted fat, place in it a piece of glass rod, and weigh without the stopper. Carefully pour about 0·25 grams of fat into a 500 cc. bottle or flask having a ground glass stopper, using the glass rod to assist in transference. Re-weigh and prepare another sample in the same manner.

Dissolve the weighed sample of fat in 10 cc. of chloroform, and then add 25 cc. of iodine monobromide solution measuring from the burette stopper, mix and allow to stand for 30 minutes in the dark, shaking occasionally (the bottle should not be left in strong light).

At the time that the iodine monobromide solution is measured into the fat, measure the same amount of solution into another bottle containing chloroform but no fat This is for blank determination.

At the end of the absorption period add 15 cc. of KI solution (of 15 per cent strength) Add 100 cc. of water, washing down any Iodine that may be on the stopper.

Titrate the unabsorbed iodine with standard Sodium Thiosulphate shaking constantly. When only a faint yellow colour remains add 1 cc. of freshly prepared solution of starch and finish the titration within one minute.

Finally the bottle should be closed and shaken until all iodine remaining in the chloroform has been extracted by the KI. The temperature should be kept as nearly constant as possible throughout the experiment.

From the volume of the Sodium Thio sulphate required for the iodine solution alone, substract that required for the fat and iodine solution. The remainder is the volume corresponding to the absorbed iodine. Then the percentage of iodine absorbed is calculated.

Saponification Value.

The saponification value indicates the number of milligrams of Potassium Hydroxide required to completely saponify one gram of oil or fat.

Procedure.—Accurately weigh the clean dry flask and then add 2 cc. of the clear melted fat with a pipette, taking care that no fat adheres to the neck of the flask. Accurately weigh again.

Run in 25 cc. of the alcoholic potash with a pipette counting the drops. Place this under a reflex condenser Then take the other flask and run in 25 cc. of alcoholic potash as before, allowing the same number of drops to fall from the pipette and attach to the reflex condenser. Then gently boil both the flask for 30 minutes rotating the fat mixture occasionally to ensure mixing. Disconnect and add 10 cc. carefully neutralised alcohol and titrate with N/2 HCL, using one cc. of phenol-phthalein as an indicator. Note number of cc's used as "a".

Titrate blank determination after adding 10 cc. of alcohol, and note result as "b".

$$\text{Therefore the Saponification Number} = \frac{(b-a \times 28{\cdot}05}{\text{Wt. of fat.}}$$

Phytosterol Test

This test shows the presence of phytosterol in the animal fat. Its absence shows the purity of ghee as the animal fat contains cholesterol not phytosterol. Its presence shows adulteration with vegetable products.

Procedure.—25 gms. of butterfat with 10 cc. of choloroform and 15 cc. of 1 per cent. solution of digitonin in 95 per cent. alcohol are shaken by hand in a small 300 cc. conical flask for about 10 minutes in a bath of water at 65° to 75°C. The mixture is then filtered hot through a Jena filter No. 11 aG. 4. This has a disc of 4 mm. diameter and 90 mm. high and holds about 100 cc. This filter is jacketed with water at 60—70°C.

If filtrate is turbid then some of the digitonide has passed through the filter. If the turbidity appears on cooling it is due to the separation of the fat chloroform alcohol mixture and not due to digitonide On adding more chloroform or on warming, the filtrate becomes clear. The digitonide on the filter is washed five or six times with chloroform, each addition being made just before the precipitate is dry, otherwise the channels form, and through washing becomes difficult. It is not drawn from the filter until the precipitate appears to be dry.

The filter is then placed in a vacuum desiccator at 2 or 3 mm. pressure for half an hour or longer. It will be found that the digitinide has assumed a paper—like texture. The bulk of it is easily removed with a mounted needle. The pure digitonide is transferred to a long form Stokes tube in which it is boiled with 5 cc. of acetic anhydride over a small flame, the neck of the tube acting as an air condenser. Heating is continued for a minute or so after the precipitate has dissolved. The solution is filtered hot into a small beaker and the tube is rinsed out with 0·5 cc. of acetate anhydride on the filter. 20 cc. of 50 per cent alcohol is then added to the solution of digitonide in the beaker and allowed to crystallise. The crystals are filtered off on a Jena filter. The crystals are washed thoroughly with a 50 per cent alcohol and dissolved off the filter with ether, the solution being received in a 10 cc.

stoppered tube from a weighing bottle. Ether is removed by warming and blowing in air. The dry sterol acetate is then dissolved by warming in 5 cc. (90 per cent by volume) alcohol and allowed to crystallise. Absolute alcohol is unsatisfactory with such small quantities of material. The crystals are filtered off through a Jena microfilter paper, and washed 4 times with the 1 cc. of cooled 90 per cent alcohol from a pipette. In India ice is used to assist the crystallization; in temperate climates this might be unnecessary. The filter is then dried overnight in a vacuum desiccator and the melting point determined In the absence of vegetable fat the M P. is invariably between 14 and 15 C. By repeated crystallization it is possible to raise it to about 115·2 C.

In the presence of as little as 10 per cent of vegetable oil the M.P. over 117 '. can be raised usually to over 120 C by another crystallization. 0·5 per cent of vegetable fat can be detected with certainty by two crystallizations.

Flourescence Test

This test depends on the flourescence developed by ghee and the adulterants. The flourescence developed in the ultra violet light by most of the organic substances depends upon the nature of the substance itself, and the composition of the ultra violet light. It is therefore of importance to use uniform apparatus and filters to get corroborative results. Usually a mercury lamp is used to generate ultra violet light for the purpose and the most important lines are said to be at 3650, 3654, 3934, 4046, 4079A.

This test was carried out by Mr. J. B. Jha at the Agra College laboratory, who put forth claims for the utility of this test; but it is so delicate and complicated that it can only be performed by an expert hand. Thus it is not commonly used.

A and B Values

Some authors claim that these tests are of much importance; but these tests are very tedious and not practicable in ghee detecting laboratories.

Melting and solidifying points.

The melting point of a solid substance is the temperature at which it changes into its liquid state.

The phenomenon of double M P. is inhibited by fats, the low M.P. being given by the non crystalline forms. When fats are gradually heated they begin to melt at a lower temperature than is required to convert the whole into a clear liquid. Thus two points are ascertainable.

(*a*) Point of incipient fusion.
(*b*) Point of complete fusion.

The point of incipient fusion is noted when the fat is seen to begin to lose its capacity and become semi transparent. That of complete fusion is the point when the fats are observed to become perfectly transparent and to contain no opaque particles. This latter point is usually given as the melting point.

The above mentioned tests are from "The standard methods of Analysis for testing and Grading ghee in U.P."

Precipitation method (sterol solubility test.)

The effect of combination of various organic liquids was studied on different mixtures of butter and animal fat to find out one which gives a precipitate with butter fat containing small amounts of animal fat but none in the case of genuine samples at the ordinary temperature in about half an hour.

Of the solvents experimented with, acetic ether was found to be suitable as its boiling point is 77 C and it can be kept dry over CaCl. Ninety three per cent alcohol was added and found to be suitable; for when 1 gm of cow or buffalo butter fat is dissolved at 30 C for 30 minutes, no precipitate appears, but a precipitate appears under the above conditions when the butter contains 50 per cent animal fat or over.

This precipitation method is a delicate test and it is not yet accepted by any standard laboratories in India for the detection of adulteration.

Acknowledgement.

At the end I express my best thanks to Mr. A. P. Brooks, Dr. B. B Malvea, and Mr. C. O. Das of the Chemistry Department, Allahabad Christian College, for their kind help in going through this article and making valuable suggestions.

LIST OF REFERENCES:

1. Indian Indigenous Milk Products, by Dr. W. L. Davies.
2. Standard Methods of Analysis for Testing and Grading Ghee.
3. Analysis of Milk and Milk Products, by H. Loffman.
4. Butter Fat, by Godbole and Sadgopal.
5. Flourescence Analysis in Ultra Violet Light, by J. B. Jha, Agra College Agra.
6. Agriculture and Live Stock in India. Vol. 5, Sept., 1935.
7. Agriculture and Live Stock in India. Vol. 5, Nov., 1935.
8. Indian Journal of Veterinary Science, March, 1940.
9. Precipitation Method. (Sterol Solubility Test). By Sanyal.
10. Journal of Indian Institute of Science, Bangalore.
11. Agricultural Marketing in India. Ghee Conference Proceedings, 1937.
12. Indian Farming, Vol. 1940, p. 284.
13. U. P. Department Agriculture (Bull. 34.), 1931.
14. Indian Journal of Veterinary Science and Animal Hus. Vol. II, 1941, p. 329.
15. Indian Farming, Vol. 2, No 10, 1941.
16. Agriculture and Live Stock, Vol. 7, Nov., 1937.
17. Agriculture and Live Stock, Vol. 8, March, 1938.
18. Agriculture and Live Stock, Vol. 8, May, 1938.
19. Agriculture and Live Stock, Vol. 9, March, 1939.
20. Agriculture and Live Stock, Vol 6, March, 1936.

UNITED PROVINCES DEPARTMENT OF AGRICULTURE. MONTHLY AGRICULTURAL REPORTS.

MARCH, 1943

I—Season:—During the month under report, the first, second and third weeks were practically rainless except for some light showers in a few districts. During the fourth week, however, light showers were received in many of the districts, mostly western, but the total rainfall for the month in all the districts was in defect of the normal.

II—Agricultural operations:—Harvesting of the *rabi* crops is in full swing as also their threshing in some districts. Crushing of sugarcane, irrigation of early *zaid* crops and sugarcane, sowing of sugarcane and late *zaid* crops are in progress. Transplantation of tobacco has commenced in the Farrukhabad district. Planting of potatoes and paddy is being done in the Dehra Dun district.

III—Standing Crops and IV—Prospects of the Harvest:—The condition of the standing crops and prospects of the harvest are, on the whole, satisfactory. The average outturns of the mango and mahua crops for the Province are estimated at 51 per cent. and 63 per cent. of the normal respectively.

V—Damage to Crops.—Damage by frost and hailstorm is reported from the Muttra district and by hailstorm alone from the Agra and Sitapur districts. Damage by fire is reported from the Partabgarh district

VI—Agricultural stock.—The condition of agricultural stock is on the whole satisfactory, although cattle diseasee have been reported from a number of districts. From Table I, compiled from data supplied by the Director, Veterinary Services, United Provinces, it would appear that there has been, since the last month, a pronounced increase in the total number of seizures, only a slight increase in the total number of deaths, and consequently a marked decrease in mortality. No cases of Anthrax and Blackquarter have been reported during the month. As regards Hæmorrhagic Septicæmia,

there has been a considerable decrease in the number of seizures, deaths and mortality. In the case of Rinderpest, there has been a marked increase both in the number of seizures as well as deaths, but only a slight increase in mortality. There has been a pronounced increase in the number of seizures from foot and mouth disease, but a marked decrease in the number of deaths, resulting in a considerable decrease in mortality. In the case of "other diseases," there has been a marked increase in the number of seizures, but a great decrease in the number of deaths, resulting in a highly pronounced decrease in mortality.

Table 1.—Number of seizures, deaths and mortality from cattle diseases in February and March, 1943

Diseases	Seizures		Death		Mortality.	
	February	March	February	March	February	March
Anthrax	..	..	..	..	..	..
Hæmorrahagic Septicæmia ..	48	26	45	22	94	85
Blackquarter ..	3	..	3		100	..
Rinderpest ..	389	479	208	262	54	55
Foot and mouth	1,169	2,100	19	3	1·6	0·14
Other diseases .	14	25	12	2	86	8
Total .	1,623	2,630	287	289	18	11

N.B.—Mortality $= \frac{\text{No. of deaths}}{\text{No. of seizures}} \times 100$

VII—Pasturage and fodder.—Sufficiency of pasturage and fodder is reported from all the districts except the Hamirpur, Jaunpur and Unao districts.

VIII—Trade and prices.—The retail prices of important agricultural commodities in rupees per maund at the end of the month under report and of the preceding month are shown in Table 2, from which it would appear that whilst the prices of wheat and arhar have remained almost stationary, there has been a slight decrease in the prices of barley and gram and a slight increase in that of rice.

Table 2.—Retail prices in rupees per maund of agricultural commodities for February and March, 1943

Commodities	Retail prices	
	February	March
Rice	11·070	11·720
Wheat	8·238	8·245
Barley	6·764	6 253
Gram	7 862	7·288
Arhar	10·932	10·874

IX—Health and labour in rural areas:—The condition of agricultural labour in rural areas has been satisfactory, although cases of plague, cholera and small-pox have been reported from some districts.

APRIL, 1943

I—Season:—During the month under report, the first week was practically rainless. Rainfall during the second, third and fourth weeks was fairly widespread, being heavier in the second and third weeks than in the fourth week. The total rainfall for the month in almost all the districts was above the normal.

II—Agricultural Operations:—Agricultural operations are generally up to date. Harvesting of the *rabi* crops is nearly finished, and threshing and winnowing are in progress. Irrigation of sugarcane and *zaid* crops is being done. In the Muttra district, the sowing of cotton and *chari* in the canal areas has commenced. The sowing of early *kharif* crops has begun at places in the Dehra Dun district.

III—Standing crops and IV—Prospects of Harvest:—The condition of the standing crops and the prospects of the harvest are on the whole satisfactory.

V—Damage to crops:—Damage by hail is reported from the Aligarh, Almora, Rae Bareli, Kheri and Partabgarh districts, and by fire from the Etawah and Rae Bareli districts Some damage has also been caused to the *rabi* crops on the threshing-floor by untimely rain.

VI—Agricultural stock:—The condition of agricultural stock is on the whole satisfactory, although cattle diseases have been reported from a number of districts. From Table 1, compiled from data supplied by the Director, Veterinary Services, United Provinces, it would appear that there has been, since the last month, a pronounced increase both in the total number of seizures as well as deaths, but a decrease in mortality. As regards Anthrax, four cases of seizures and three of deaths, resulting in 75 per cent. mortality, have been reported during the month as against no cases during the preceding month. There has been a marked increase in the number of seizures from Hæmorrhagic Septicæmia, only a slight increase in the number of deaths and a marked decrease in mortality. Three cases of seizures and deaths from Blackquarter have been reported during the month as against no cases during the preceding month. As regards Rinderpest, there has been a marked increase both in the number of seizures as well as deaths, but a decrease in mortality. In the case of foot and mouth disease, there has been a pronounced increase in the number of seizures as well as deaths, and mortality. There has been a very considerable decrease in the number of seizures from "Other Diseases," a slight increase in the number of deaths and consequently a highly marked increase in mortality.

Table 1.—*Number of seizures, deaths and mortality from cattle diseases in March and April, 1943.*

Diseases	Seizures		Deaths		Mortality	
	March	April	March	April	March	April
Anthrax ..	..	4	..	3	..	75
Hæmorrhagic Septicæmia ..	26	44	22	23	85	52
Blackquarter ..	..	3		3	.	100
Rinderpest ..	479	993	262	472	55	48
Foot and mouth ..	2,100	5,970	3	48	0·14	0·80
Other diseases ..	25	6	2	3	8	50
Total ..	2,630	7,020	289	552	11	8

N.B.—Mortality $= \frac{\text{No. of deaths}}{\text{No. of seizures}} \times 100$

VII.—Pasturage and fodder:—Sufficiency of pasturage and fodder is reported from all the districts except the Hamirpur, Jaunpur, Ballia, Unao and Rae Bareli districts.

VIII.– Trade and prices: –The retail prices of important agricultural commodities' in rupees per maund at the end of the month under report and of the preceding month are shown in Table 2, from which it would appear that there has been a pronounced increase in the prices of rice, wheat and barley and a slight increase in that of gram and *arhar dal*.

Table 2.—Retail prices in rupees per maund of Agricultural commodities for March and April, 1943.

Commodities	Retail prices	
	March	April
Rice	11·720	13·362
Wheat	8·245	10 253
Barley	6·253	7·145
Gram	7·288	7·601
Arhar dal	10·874	11·423

IX.—Health and labour in rural areas:—The condition of agricultural labour in rural areas has been satisfactory, although cases of plague, cholera and small-pox have been reported from some districts.

Shellac is produced by insects, practically all living in India, which transform the gum of trees into resin.

Peanut oil, now being used for cooking, is used industrially in shaving lotions, cosmetics, soaps, dyes and axle grease; and medically, among other uses, in massage for infantile paralysis victims.

REVIEW

THE PRESERVATION NUMBER

(*The* 1942 *Annual Number of the Punjab Fruit Journal*)

Foreword by the Hon'ble Rao Bahadur Ch. Sir Chhotu Ram, Minister for Revenue, Punjab.

Edited by S. B. S. Lal Singh, Fruit Specialist, Punjab, Lyallpur

and

Dr. Girdhari Lal, Bio-Chemist, Fruit Products Laboratories, Lyallpur.

Available from The Punjab P. C. Fruit Development Board, Lyallpur.

"There is an extreme dearth of authentic literature dealing with fruit and vegetable preservation pertaining to Indian conditions, as books written by foreign authors do not fully answer our purpose. There was, consequently, a keen demand for the publication of suitable literature on the subject. And this demand has been still further intensified by the present war inasmuch, as importation of foreign products has almost completely stopped, there is need for local production, and in fact, a rare opportunity to develop this industry when it can have a normal chance of survival without being strangled by foreign competition."

Keeping the above in view, the Punjab Fruit Development Board, which has earned a reputation for bringing authoritative literature on gardening suitable to Indian conditions, has devoted the fifth Annual Number of the Punjab Fruit Journal exclusively to the Fruit and Vegetable Preservation Industry. We congratulate our contemporary in completing its first quinquennium and for establishing itself as a successful venture in horticultural journalism in the East.

This compendium will surely be of immense use to those who are interested in Fruit and Vegetable Preservation and will be welcomed alike by research scholars and commercial magnates.

It is a handy illustrated Annual comprising seventy (70) pages replete with facts essential for starting the Preservation Industry both as a war and post-war measure. Some of the most informative articles in this 'souvenir' are:

Future of Fruit Preservation Industry—War and the Preservation Industry—Facilities for Training in Fruit Preservation—Equipment for a Fruit Preservation Factory—Preparation of Citrus Fruit Squashes and Cordials—Preparation and Preservation of Unfermented Apple Juice—Preparation of Jam from pears and plums—Tomato Ketchup—Tomato Juice—Guava Cheese—Pickling of Vegetables—Drying of Vegetables—Vinegar Manufacture for Home Use—Control of 'Spoilage' in Canned Foods—Summary of the work done in Fruit and Vegetable Preservation at the Fruit Products Laboratories, Lyallpur—Directory of Firms Supplying Fruit Products and Fruits.

This Number is priced at Re. 1-8 including postage on pre-paid Money Order basis or V.P.P. basis; but to regular subscribers of the journal and the members of the Punjab Fruit Development Board, this Number along with other issues of the journal is supplied free. The Annual subscription of the journal is Rs. 3 on pre-paid Money Order basis and Rs. 3-8 per V.P.P. basis.

NOTE:—Popular abridged Urdu Edition of this Special Preservation Number, comprising 40 pages of the reading matter priced at Re. one including postage on pre-paid Money Order basis or V.P.P. basis, is also available for sale.

For further particulars please write to—

THE HONY. SECRETARY,
Punjab P. C. Fruit Development Board, Ltd.
Punjab Agricultural College, Lyallpur (India)

Registered No. A-925

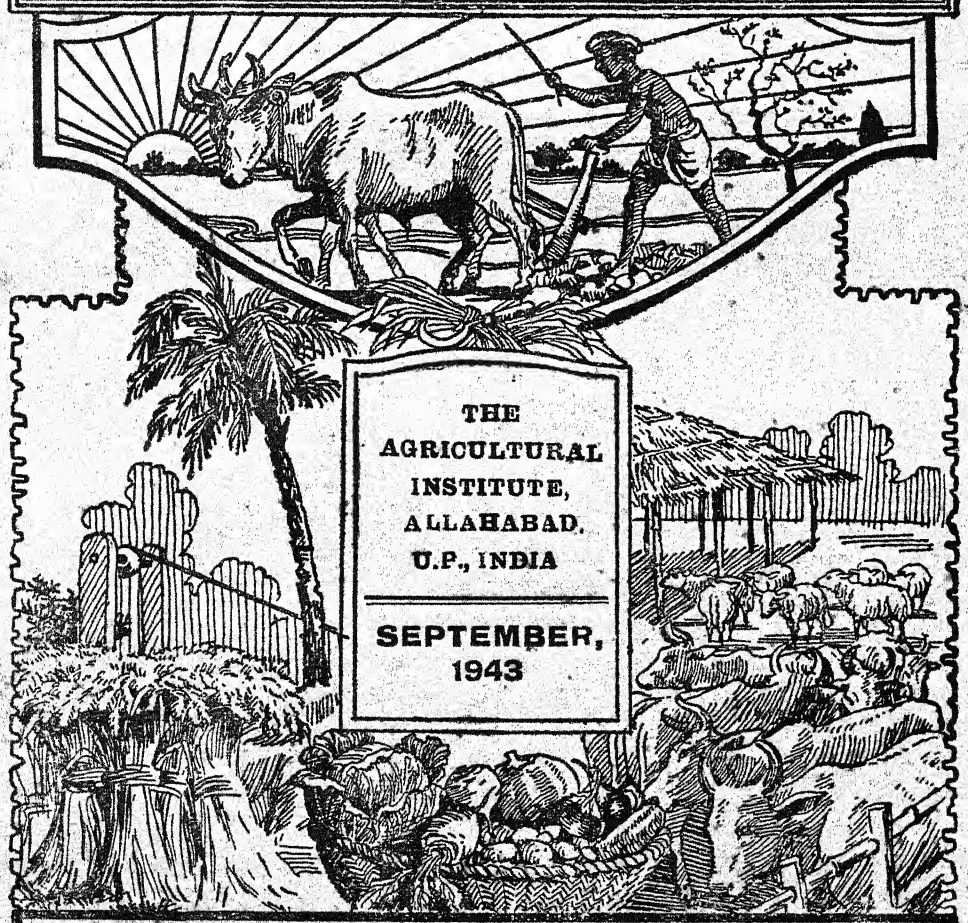
VOL. XVII] [No. 5

THE ALLAHABAD FARMER

A bi-monthly Journal

OF

Agriculture and Rural Life



THE AGRICULTURAL INSTITUTE, ALLAHABAD, U.P., INDIA

SEPTEMBER, 1943

"An important trend in agricultural research and administration in many parts of the world will be towards a classification of land and the planning of its future use, having in view the two main aspects, the provision of the requirements of the world's population, and the conservation of the soil and water resources in all countries."

THE ALLAHABAD FARMER

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

The Allahabad Farmer is now approved by the Directors of Public Instruction in the United Provinces, Bengal, Central Provinces, Sind, Assam, Bihar, and Orissa, the Rural Reconstruction Commissioner, Punjab, and by the Director of the Institute of Plant Industry, Indore, and Agricultural Adviser to Rajputana and Central India States, for use in all schools under their jurisdiction.

Subscription Rates

Annual subscription : India, Rs. 3; England, 4 shillings; U.S.A., 1 dollar. Single copies, 10 annas; over five years old, 12 annas. Copies which are not received by subscribers will be supplied free of cost within six months of the month of issue. Thereafter single copy prices will be charged.

Unused portions of subscriptions cannot be refunded.

Advertising Rates

	Rs.	a.	p.
One full page of six numbers	35	0	0
One single full page	7	0	0
One half page of six numbers	20	0	0
One single half page	4	0	0
Page 2 or 3 of cover for six numbers ...	50	0	0
Page 4 of cover for six numbers	70	0	0

Contributions

The Allahabad Farmer is published in the first week of each alternate month commencing with the month of January. Contributors are requested to send in their articles at least one month prior to the next prospective date of publication.

Contributors will receive 15 reprints of the article published and additional copies at cost.

Publisher—The Allahabad Agricultural Institute, Allahabad, U.P. (American Presbyterian Mission).

Printer—The Mission Press, Allahabad, U. P.

Business correspondence should be addressed to the Business Manager, Allahabad Farmer.

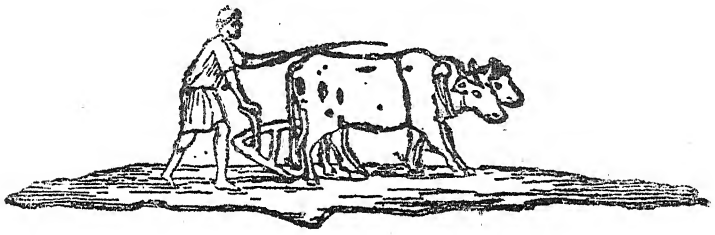
The Allahabad Farmer

A BI-MONTHLY JOURNAL OF AGRICULTURE AND RURAL LIFE

Vol. XVII] SEPTEMBER, 1943 [No. 4

Table of Contents

THE ALLAHABAD FARMER



VOL. XVII] SEPTEMBER, 1943 [No. 5

Editorials

This issue, a Report Number.

This issue of the Allahabad Farmer is again a report number of the Allahabad Agricultural Institute. It is the third report number. The first and second appeared in 1942; the former in January and the latter in September. The Editorial Committee has decided to publish this report number every year in the September issue.

Several of our readers seem to have appreciated the information which they got through this report number, and their comments have encouraged us in continuing this practice.

In these war days when food seems so scarce everywhere, it seems necessary that we should devote our energies in the production of food. The Institute, although primarily a teaching institution, is doing its best to make its contribution to the effort at producing more food. This report will show some of our activities in that direction.

The Principal's Statement.

I am asked to write an editorial for the Annual Report Number of The Allahabad Farmer. I gladly do this, as in spite of shortages of staff and equipment, and for part of the year, very disturbed

conditions which affected our students adversely, the report on the whole is one of progress.

Since the last report the draught scheme for ox harness and ox type financed by the Imperial Government is now well on the way. The government statistician and geneticist has spent several days in conference so as to get the best results out of the investigation.

The degree course in Agricultural Engineering started its second year with a full quota of students.

The Government has paid in to the Institute its share, Rs. 10,000, towards the new hospital and dispensary which is not only to care for Institute needs but will also take better care of the large number of village folk who come regularly to the existing farm dispensary. The coming of Dr. and Mrs Beach to Allahabad has enabled Dr. Hayes to spend much more time on this side of the river where she is one of the busiest persons that I know anything about. It seems as if she was on the go both night and day. The added facilities will increase the usefulness of the medical work of the Institute.

The year has been one of extreme anxiety because with more than 700 head of live-stock—cattle, sheep, goats and pigs, not less than 300 maunds or 10 tons of fodder have been required daily. For much of the time it has been exceedingly difficult to find this amount of fodder. We were compelled to go out and buy some dry fodder. We have had the worst fodder shortage in thirty years, causes:—the highest river in eight years which flooded our best fodder fields, and also untimely heavy rains at the planting of nearly a hundred acres of fodder where just after sowing the seed was beaten in or washed out or rotted in the ground. Had we only been able to secure enough labour we might have made use of more grass and weeds, but with many war time enterprises going on in our neighbourhood, many thousands of village farm labourers were diverted to the war work. But even with the best we could do some days our cattle did not get enough. This reflects itself in a decrease of 75,000 lbs. of milk in the dairy, and in a delayed calving

programme. As soon as we saw the impending shortage of fodder we made use of the tube well irrigation and heavily manured and cultivated land which heretofore had grown very little, and we had magnificent crops which provided great help. We also grew about six acres of green oats and four acres of berseem. We also extended the area under Napier grass, this latter grass being the heaviest yielding fodder grass of which I have any knowledge. Under our conditions, with plenty of manure and irrigation water, we are getting as high as 3000 maunds, or more than 100 long tons per acre per year. Napier grass goes on year after year. The Institute sells a great deal of Napier grass roots and stems to people from all over Nothern India who wish to increase the fodder resources

Under the tube well area we planted several acres of vegetables for the American troops but by the time the vegetables were ready the Americans had moved on. For some of these things like lettuce there was no local market, but most of the things found a ready market at prices that paid for growing them. We had the last rain about the 23rd of September. An article on Indian Farming by Mr. Parr shows that a critical time for rain for the preparation of the ground for the winter crops—*i.e.* temperate zone vegetables and grains, cabbages, cauliflowers, potatoes, wheat, barley—is heavy rain around the last week of September when the ground is well prepared to absorb it. The close of the rains was followed by very hot weather. The result was that while we had the largest acreage we had ever had of these winter crops which are mainly food crops, we had the lowest yields we have ever had. The tube well which proved of such great value did not come into flow until the 15th of October and even then we had to get the electric wire, motor and pump which was available, not the one suited to the capacity of the well. We think we were able to get about half of the water that the well could have produced had we only had the proper equipment. We are hoping, when war needs permit, to get suitable equipment for the tube well

Another very interesting development is under the Agricultural Engineer, Mr. Vaugh, who on about forty acres

is seeing what can be done on rain-fed land, *i.e.* land without any irrigation facilities Over a series of years this should provide information, as for a good many years to come, most of the land of India will have to be cultivated without irrigation water ; though irrigation facilities if developed could develop the area under irrigation. Irrigation is perhaps the best insurance against crop failure that we have in India today.

Again, the Institute's system of soil management, that is, plowing of the land when it is as hard as it possibly can be, in April, May and June, enables the farm to plant its fodder seeds and green manuring seeds with the first shower of rain. This year the rains were delayed, and at first they were just barely enough to keep things going. After about a month there has been continuous rain and cloudy weather and almost no sunshine Thus due to our being ready and planting early, it looks as though we would have a normal fodder crop, though our neighbours who have had to wait for the rain to soften up the soil, which when it comes, washes off much of the organic matter and causes terific loss by erosion, very few of them have any fodder crops. We were not the only ones who suffered from fodder shortage. The whole countryside had about the worst fodder shortage I have known and prices for all kinds of grasses, edible weeds were higher than I have ever known But if the principle of soil management worked out by the Institute can be copied on a large scale, enough fodder could be grown to supply the normal needs of the district. This year the Institute is planting forty acres of land under tube well irrigation to vegetables as part of the Grow More Food Campaign

While to those who visit us the Institute seems well equipped and staffed, those who are responsible know how much more equipment, buildings and staff are needed to enable the Institute to take advantage of the many urgent opportunities to serve India.

We are all out for the grow more food campaign, having planned to put out an additional forty acres of vegetables to help meet the demand. This taxes our resources to the limit.

SAM HIGGINBOTTOM.

REPORT OF THE DEPARTMENT OF HORTICULTURE, 1942 43.

By

W. B. HAYES

In the last two reports, mention has been made of a disease which appeared on certain citrus trees for the first time in the winter of 1941-42. Many twigs wilted and died, and drops of gum formed at the leaf scars. The disease spread for a few weeks only. Later the dead twigs were removed, and there was no further trouble. About a year later similar symptoms appeared on a few trees These trees had suffered little if any the year before. The gumming which had been prominent the first year was almost entirely lacking. Specimens were sent for identification by Mr. L. P. Khanna of the Department of Biology, Ewing Christian College. The fungus was identified by K. F. Kheswalla of the Imperial Agricultural Research Institute, New Delhi, as *Collectotrichum gloeosporioides* Penz. This is the cause of the rather common disease, wither-tip or anthracnose, known to occur throughout India, but believed to be serious only in certain tracts near the mountains in the Punjab. It is surprising to find it causing serious damage here, and the presence of gum also seems to be unusual. The affected twigs were carefully removed and burned, and it is hoped that there will be no further serious recurrence of the disease Ordinarily, wither-tip is serious only if the trees have been weakened by some other factor. These trees were in good health, except for a fairly heavy infestation of white fly, which may have been sufficient to prepare the way for the disease. The white fly has been largely reduced by spraying with tobacco decoction.

More grapefruit trees which had been severely attacked by gummosis died during the summer. Others, in which the disease had been controlled, seem to be regaining their vigour. In several cases, where there were large wounds on the trunk, cutting off some of the roots, seedling trees inarched into the trunk above the wounds are growing well,

and seem to have contributed to the recovery of the tree. The flooding of the orchard by the Jumna river for the second time since it was planted, may have caused a renewed outbreak of gummosis.

Records of estimated production of heavily and lightly pruned guavas were again made. As in previous years, the heavily pruned trees failed to produce a satisfactory crop. In 1943, some trees were pruned the first of April, in addition to the previous dates, the first of May, June, and July.

Mention was made last year of a citrus fruit found growing wild in the Kumaun. This has been tentatively identified as *Citrus macroptera* var. *combara*. One of the seedlings has been planted in the variety orchard, along with a 'jamir' seedling also brought from Kumaun.

For obvious reasons, this is not a good time to introduce plants from outside India, or even from distant parts of India, so there have not been many additions to the variety orchard. Seedlings from four different types of citrus from Assam have been transplanted from the nursery to the orchard, and are thriving, and a Sylhet lime and 'Bijauri lemon' (probably a ciron) propagated from trees in the local Government garden, have been added to the collection. Trees of the Black Ischia fig were secured from Lucknow, where they are reported to do well, and are growing well, but thus far behave like the other figs, flowering, but producing very few edible fruits. Some of the tangelo varieties brought from the United States in 1940 are growing fairly well; others do not seem well adapted to the climate. They are being propagated on *khatta nimbu* rootstock. A Valencia orange, Kinnow mandarin, and Meyer lemon, secured at the same time, are becoming well established after a slow recovery from two months in the mail.

Further experiments with the treatment of seeds with hard coats were made. As reported in January, 1942, treatment with concentrated sulphuric acid gave the best results with *babul* (*Acacia arabica*) and guava seed. Somewhat shorter periods of soaking proved most satisfactory, 10 minutes for *babul* and 15 for guava. Ten minutes in the acid also proved best with the soapnut, giving good germination in

(Continued on page 187).

REPORT OF THE AGRICULTURAL ENGINEERING DEPARTMENT, 1942-43

By

MASON VAUGH

In some respects, the year 1942-43 seems likely to be memorable in the future of agricultural engineering in India. In July 1942, the first class was admitted for professional training of a degree standard. This was not only the first class to be admitted at Allahabad but so far as is known, the first such class in South Eastern Asia, certainly the first in India.

A full class of 12 students was admitted and a number of other applicants were regretfully refused admission because of lack of accommodation. When it was too late to give his seat to another, one man left, but 11 completed the year, 9 being promoted to the last year. All 9 have returned in July 1943.

The class was handicapped by the August disturbances and by the fact that some who entered at first changed to other branches of agriculture later. Some students who were very anxious to take the engineering were forced by their parents to join other lines and some who wanted to study other branches were urged to take engineering. This did not perhaps provide the best material in the student body.

A further handicap was the difficulty of getting teachers. Of three teachers to be appointed, only one engineer was secured, Mr. J. L. Joneja, B. Sc (Engr), and the implement salesman, Mr. P K. Bhargava, B. Sc. (Agr.), had to be transferred to teaching duties for the whole of the academic year up to April 1st 1943. This year we have been more fortunate in securing staff. Mr. J. L. Jethi, B. Sc. (Engr.), and Mr. B. D. Saxena, M.Sc., L.T., have joined their posts and Mr. P. Singh, B Sc. (Engr.), is expected to join on Sept. 1st. With the exception of a part time assistant to be shared with another department, the staff is now complete.

A second event which we think will be of some considerable importance was the starting of work under the scheme financed by the Imperial Council of Agricultural Research for testing of yokes and harnesses and for a study of the body conformation factors in the bullock as related to draft ability. While there have been isolated testing of and designing of yokes, and harnesses, this is so far as we know the first comprehensive scheme to test a wide variety of yokes and harnesses. It is also, so far as we have been able to determine, the first comprehensive attempt to study and to tests bullocks with a view to finding out what body conformation factors really contribute to draft ability. Very little testing of the draft ability of bullocks has been done anywhere even with a view to determining what is the draft ability of the bullock.

A third scheme came into operation at the end of the year but was largely planned and arranged for earlier, that of a special small farm set aside for the purpose of experimenting on the problems of implements and machines for the small farm under rain-fed or non-irrigated conditions. An area of about 40 acres of moderately poor, uneven land somewhat detached from the Institute main farm and about half a mile from the compound of the college has been set aside for this purpose and put in the control of the Agricultural Engineering department so far as all operations up to the harvesting of the crops is concerned. Crops grown will be turned over to the Farm manager for disposal when ready. The purpose is to explore the problems facing the small and medium sized farmer, to develop implements and cultivation procedures and practices which he can utilise and to study the effect of the new procedures proposed on soil fertility and so on yields. A separate farmstead with a small house for one family and a shed for the work animals has been set up. Two pairs of cows, one in milk and the other at present dry, have been broken to work and the attempt is being made to work the area with only the power of these four cows In the present *kharif* season, about 10 acres have been sown to green manuring crops and about 30 acres to mostly *juar* but with small areas of *guar*, *arhar*, cowpeas, rice, *bajra* and sweet potatoes. Completely separate accounts are being

kept of labour, seeds, bullock power—including milk yields of the cows—and of yields. It is hoped that eventually silos may be provided and other improved facilities developed and tested which would be suitable for general introduction in villages It will take several years of course before any final opinions can be drawn but it is hoped that annual statements can be given as progress reports either in the annual report number of the Farmer or otherwise. Aside from the implement and machinery problems being studied, particular attention will be given to farm management problems having to do with the distribution of labour throughout the year and how this is affected by the implements used.

The manufacture of implements during the period was greatly hampered by the high cost and scarcity of material and labour. Ram Jiawan, blacksmith, who had given outstanding help in the development of new implements and in the perfecting of methods of manufacture under our conditions died early in the period under report after being sick for some months. Several other experienced men left to work on war jobs or on construction work in connection with the war effort New employees are difficult to find and since our work is different from that in most workshops, even though they may be skilled, new men have to go through a period of training and of acquiring experience before they are able to fully take up their duties Just as this report is being prepared, a communication from Government has come indicating that there may soon be help for manufacturers of agricultural implements which is greatly needed, in securing necessary material. If this materialises, it will greatly help in making available the necessary implements for the grow more food campaign at reasonable costs.

During the year April 1st., 1942 to March 31st, 1943, the following implements were sold and delivered by the Institute workshop :

Shabash ploughs	487
Shabash cultivators	8
Wah Wah plough sets	66
U. P. Ploughs	...
6 row seeding machines	6

Butter churns	4
Butter workers...	4
Spare shares for ploughs	680
Garden hoes and rakes	77
Scoops or scrapers	1
Garden shears and loppers	14
Bull nose rings...	10
Latrine borers	18
Butter scoops, molds etc.	26
Milk ladles	8
Nagpuri yokes	15
Total number of items	1,424
Total value of implements sold Rs	10,102-6-3

One very large order received at the end of the year for immediate delivery had to be refused because of lack of stocks. It amounted to 760 ploughs and about 2,000 spare shares. Other small orders for small items and single grain drills or other implements sold singly had to be refused. There were many enquiries for dairy equipment, particularly for milk cans, pasteurisers and cheese equipment which could not be offered, mainly due to the materials situation. Had it been possible to supply all the things enquired for or ordered, our business would have been much more than doubled.

Many enquiries have continued to come for advice and recommendations about equipment and practices It seems certain that the war has not slowed down the increase in interest in better implements but has probably on the other hand increased it. The Agricultural Engineering Department continues to consider that one of its most important contributions to improving Indian agriculture is the answering of these enquiries and it welcomes them.

REPORT OF THE DEPARTMENT OF BIOLOGY
1942-43.

By

W. K. Wesley.

Staff:—Edgar F. Vestal (on furlough), Botany and Plant Pathology.

W. K. Wesley, Zoology and Entomology.
T. A. Koshy, Biology
A. Dayal Chand, Plant Pathology.
T. W. Millen, Bacteriology
S. R Barooah, Agricultural Botany.

General:—Mr. W. K Wesley continued as the officiating Head of the Department. Mr. S. R. Barooah took over the teaching of Agricultural Botany.

Besides the regular students, several casual students also receive training here.

Botany and Plant Pathology:—A number of cultures of fungi isolated here as well as those obtained from elsewhere were maintained for use in class work. We express our thanks to the Imperial Mycologist, Imperial Agricultural Research Institute, New Delhi, and the Botany Department of the Allahabad University for supplying us some cultures of fungi.

Many enquiries regarding control of plant diseases were answered suggesting suitable remedies in each case.

Experiments were carried on to test the effect of sulphuric acid on the germination of seeds which ordinarily take a very long time to germinate. Carrot seeds which usually take 10 to 15 days to germinate were treated with concentrated sulphuric acid for different lengths of time, the maximum being 20 minutes. It was noted that seeds which were treated for more than one minute did not germinate at all, so it can be concluded that lower concentration is likely to give better results. Sweet pea seeds were also treated with 50 per cent sulphuric acid from one to 20 minutes and it

has been found that 20 minutes exposure to the acid gives the best result.

On the suggestion of Dr. Ranjan, Head of the Department of Botany, Allahabad University, Mr. S. R. Barooah, is carrying on two experiments in plant physiology in co-operation with the Agronomy Department. The first one is to determine the effect of different oil cakes on the growth and metabolism of paddy. It is a randomised block experiment with five treatments (control, castor cake, *mahua* cake, *neem* cake and linseed cake). The variety of paddy which has been selected for experimentation is Bansmati.

The second experiment is to find out the effect of different doses of boric acid on the growth and metabolism of paddy. It has been reported that boric acid, if applied in excess, has a tonic effect on paddy. In this experiment therefore, doses of 1 lb., 5 lbs., 10 lbs., and 20 lbs, per acre are being tried It is a randomised block experiment with 4 replications and 5 treatments

The results of these two experiments will be published later when the experiments are completed and data analysed.

Entomology:—Observations were made on the life histories and control of Woglum's Black Fly and the Mango hopper.

1. The Woglum's Black Fly, *Aleurocanthuss spiniferus* Q., also known as the citrus mealy wing or citrus white fly has been reported from various places in the East. It is quite common here on the Institute farm on citrus plants during and after the rains. During the rains it is found in the pupa stage only.

It is a small fly belonging to the family Aleurodidae of Homoptera under Rhynchota. Its length varies from one-twentyfifth of an inch to one-eighth of an inch The abdomen appears dark orange with the head and thorax looking still darker. The wings are spotted slaty orange in colour. The margins of the wings are toothed with spines which are both orange red in colour. There is present only a single, unbranched vein about the middle of the wing.

The mated female lays small, yellowish brown eggs on the leaves of all citrus species. These eggs hatch in one to

two weeks into little nymphs, brownish in colour. The nymphs suck the cell sap for about a month or two and then pupate as black, oval objects with from ninety to one hundred blunt marginal teeth and over fifty bristles on the back. The adults come out of these pupa cases in about three to four months.

The pest, besides feeding on the sap in the nymphal stages, also secretes honey dew from the alimentary canal which affords an excellent medium for the growth of a sooty fungus and the leaves The leaves get covered with the black material which mars the normal health of the plant. In cases of serious attacks the affected trees produce less fruits and of poor quality.

Control:—Spraying with tobacco decoction has proved quite successful in checking the pest. One seer of tabacco refuse is soaked in two gallons of water for twenty hours and the extract separated. If the refuse seems to be rich in its contents it can again be soaked in another two gallons of water and the extract obtained. This stock solution is diluted six to seven times with water before used as a spray. The efficacy of this insecticide is enhanced by the addition of a quarter of a seer of soft soap to every two gallons of stock solution.

Brumus saturalis :—F., has been seen to feed on the eggs and nymphs of these flies Citrus plants that are grown on scientific lines and are receiving sufficient amount of light and air resist the pest better.

2. Mango hopper, *Idiocerus* Spp., is a small sucking insect commonly found in the mango groves of India They are very abundant in U P. in the following places:—Agra, Allahabad, Benares, Cawnpore, Dehra Dun, Fatehgarh, Farrukhabad, Haldwani, Lucknow, Moradabad, and Saharanpur. During certain years they are so abundant that it gets very difficult to pass under the infected trees and at nights at some of the railway stations like Allahabad and Lucknow, where there are strong electric lights it becomes impassable under these lights due to the beam of hoppers from the lights to the ground.

Nature of damage.—The damage is partly done by wounding the tissues of plants for egg laying by the female

and partly by the nymphs for sucking the juice, the later prove more deterimental to the tree. Nymphs while feeding give out a sugary substance which falls on the leaf and the flowers below giving them a shiny sticky appearance This encourages the growth of sooty fungus which was the health of the tree.

Extent of damage:—The earliest appearance of damage can be imagined from the fact that during years of heavy attack trees which normally yield hundreds of mangoes produce not a single fruit.

Life History.—The eggs of mango hopper are very small and translucent. They are deposited in the tissue of soft floral shoots and stalks of flowers. Very often the eggs are laid in the unopened flower buds at the end of February and and in March. Nymphs hatch out from the eggs in a week or so. They look transparent, with yellowish tinge and have red eyes, with a pair of fine antennæ and three pairs of long legs. They feed, grow and mould five times and are full grown in two to three weeks. They are abundantly found in March and April.

There are usually two species of mango hopper seen in the U P. *viz*., the larger and the smaller mango hopper. The winged individuals of the previous year survive throughout the year, taking shelter during the winter in the crevices of the bark. During the mango season (April—June) they are present in great abundance, but later on as the season advances they are reduced in number, being killed by heat, rain and enemies. Those that survive become active again and come out of the crevices of the bark in February and March when the mango flowers are just appearing on the shoots and begin to lay eggs in the new inflorescene.

Control Measures.—Unfortunately the stage of the insect which is responsible for most of the damage co-exists with the flowering season of the mango and therefore not much can be done at that time. Hence it is advisable to destroy the pest before the flowering season. For this purpose spraying should be done during winter As the insect is rather active and it is not very easy to cover it successfully with any contact insecticide during the day, spraying should

be resorted to the cooler part of the day: early in the morning has proved quite successful because the hoppers at this time are rather inactive due to the influence of the cold.

The insecticides which have proved very successful are rosin-wash and crude oil emulsion

Most of the old fruit orchards were planted without any regard to the requirements of the tree and so they were put so close together that no entrance of light is possible, the result is that the trees are unhealthy, they try to grow in height but do not have any branches sideways, this growth is defective and the tree is liable to suffer from diseases. So in order to enable the trees to ward off diseases we must take into consideration the various factors governing the health of a tree when planting an orchard. Besides other things, there should be enough provision for light and air. Trees that are exposed to the sun and get plenty of air are vigorous in growth and are not much attacked by insects, they resist the attack successfully. It is therefore advisable in the case of already thickly planted orchards that they should be thinned and the useless trees removed Further, all dried and useless branches should be removed.

(*Continued from page* 178)

11 days, compared with very poor germination beginning in 26 days when the seed was not treated.

Work on fruit products has been continued Jam, jelly, and squash were successfully prepared from one variety of mulberry. This may prove of considerable commercial value, as plantations are easily established from cuttings and come into bearing at an early age, and the fruit is ripe in the spring when very few other fruits are available, and the factory might otherwise be closed. Chutney prepared from the karanda compared favourably with that made from mangoes. Mango squash was further improved, and work started on the stabilization of tomato juice

Some experimental work had to be dropped temporarily because of lack of time on the part of the staff Mr. K. B. Mathur returned in August. 1943, after being away from Allahabad for more than a year, and is re-starting some work, and giving more time to more-or-less neglected projects.

REPORT OF THE AGRONOMY DEPARTMENT
1942-43

By

B. M. Pugh and S. R Misra.

Staff.

B. M. Pugh, Head of the Department.

S. R. Barooah, Agronomy and Soils

G. Q. Vachoo, Marketing.

S. R. Misra, Farm Management and Farm Accounts.

S C. Bhatnagar, (Part time) Field Experiments.

Dr. Higginbottom, Principal and Head of the Economics Department, helped this department, by acting as Farm Manager.

Teaching.

During this year the teaching in the department was done by B. M. Pugh, S. R Barooah and S R Misra.

Research.

During this year the department continued to carry on experiments which had been started from previous years. The experiment on sugar cane in co operation with the Department of Agriculture, U.P., continued. The 9 varieties under experiment, namely Co-313, Co-312, CoS-146, Co-527, Co-393, CoS-76, CoS-5, Co-331 and Co-421. The varieties are mentioned in the order of the performance of their yield. These reports, however, are only indications of their productive capacity as they were planted in just a few rows. The experiment is being continued and a randomised block experiment has been laid out. In this experiment Brix readings of only 7 varieties were taken as there was not sufficient juice in the others. These readings were as follow :—Co—421 = 20·25, Co – 331 = 20·0 CoS – 76 = 22·5, Co – 527 = 23·5, Co – 393 = 23·5, Co – 313 = 25·5, Co = 12 – 2 ·0. Final readings of this experiment however, will be published at the end of the third year of experimentation with randomised block lay-outs.

Another crop that was under experiment this year was rice. 31 varieties including several local types and those recommended by the Department of Agriculture were under trial. Of these only 9 varieties—were included in a randomised block lay-out. Their yields were as follows :—Basmati 35·65, Jhalore = 32·35, Type 1 = 9·5, Type 136 = 7·95. A −64 = 6·55, Durga = 6 25, Badshah = 12·85, Local = 36 75, and Bansi = 25·1. Of the other varieties that were under trial in small plots the following have indicated superiority over the others. Jarwan, Jalhaur, P— 17, Lejura. This experiment on the finding of the best variety of rice for the locality is being continued.

Another experiment that was continued last year was a manurial experiment. This was an experiment to find out how much better trench manure is than farm compost or green manure. The experiment was also to find out the number of years that trench manure is effective. The experiment was in its 4th year and the result during the year under experiment showed that trench manure is far superior to the other two at the end of the 3rd year. In fact, farm compost and green manure did not show better results than control, whereas trench manure had a yield of juar (which was a crop under experiment) more than 3 times that of the other 3 treatments. The complete report of this experiment will be given later.

Another crop that was under experiment was cotton, but the growth of this crop this year was very poor; so we do not consider the results worth reporting.

Another crop that was under experiment was *juar*. Varieties of this crop were tested for their fodder value. The order of their performance for this quality was as follows :— Malwa White = 2437·0, Do-Dana White = 2017·0, 8 − B = 1749·5, T − 9 = 1675·4, 5 Tall = 1588 0. The first was a selection by B. M. Pugh from the Central India *juars*. The next is a local selection and the last 3 are varieties of the Department of Agriculture, U. P.

This crop was also experimented on its quality as grain *juar*. Seven varieties were put in a randomised block lay-out experiment. The weights of the grain obtained from these varieties were as follows :—Do-Dana Yellow = 127·20,

5 Tall=109·80, T–9=109 50,Do-Dana White=111 30, 8–B=94·05, Malwa White=91·40, Single Dana White =86·30. This experiment is being continued this year and final results when properly analyzed will be published later.

Another crop that was under experiment was *arhar*. This crop was harvested too late because of the shortage of labour so that there was considerable shattering before harvesting. We do not consider the reporting of the results on this crop as justifiable.

Another crop that was under experiment was *bajra*. Three varieties were under trial in a randomised block lay out: a local selection, Type 16 and Type 11. Of these 3, "Local" showed to be the best with a yield of 120 75; T –16 came next with 103 00, and T–11 was the worst with only 90·00. This experiment on *bajra* is being continued.

Another crop that was under study this year was gram. Five varieties were put in a randomised block lay-out These were T–17, T–28, I.P. 25, I P. 53 and Local. The order of merit seems to be indicated by the following results. Local=85 65, T.17=83·0, I.P. 53=8 ·85, I P. 25=71·70, T–28=62·85. The data have not been analysed statistically, and it is hoped, that these data along with others we expect to get in a course of 3 or 4 years of experimentation with these varieties, will be published later.

Another crop that was under experiment this year was linseed. Four varieties were tested in a randomised block lay-out. Local, E. B. T. 1193, "Nagpur," and E. B. T. 1150. Their performances in respect of the weight of the grain were as follows:—E.B.T–1193=49·35, E B. T.1150=48.90 Local=46·7) and "Nagpur"=35·20. The experiment on this crop will be continued again the following season.

Another crop that was under experiment this year was mustard and 5 varieties were under trial. The quality of their performance with respect to the weight of seed seems to be indicated by the following results:—Local selection= 76·85, R.T. 9=72·65, R.T. 2=38·00, R.T. 11=47·95, R.T. 3=34·55. However, the germination of this crop this year was very poor. It, is therefore, expected that this experiment would be continued again the following season.

Another crop that was experimented with this year was barley. We made a report on this experiment in connection with this crop in the "Allahabad Farmer;" Vol. XVII, No. 4. But this year, feeling more ambitious, we included altogether 8 varieties in a ramdomised block experiment. The results this year are indicated by the following weights of grain of the varieties. T·20 = 126·20, I.P. 2 = 103 60, C. 251 = 103·25, Loc 1 = 102·70, 300A = 102·10, I. P. 13 = 89·25, H. 192 = 78·95, T.24 = 60·15.

Another crop that was under experiment this year was oats both for fodder and for grain. The fodder was harvested twice and the results were as follows:—C I 3253 = 781 0, Westene = 768·5, Local = 822·5, Mulga = 939·5, C. I. 2954 = 820·5, C. I. 2820 = 828·8. From these results it appears that Mulga, the variety obtained from Indore, is the best for fodder. In the experiment with this crop for grain quality the following results indicated their order of merit: I. P. 2 = 71·50, C. I. 3253 = 69·35, Mulga = 66·15, Local = 5 .·15, Westene = 36 40, C. I. 2054 = 29 25. C. I. 2820 = 20·20.

Another crop that was again experimented on this year was wheat. A previous report on the results of the experiment on this crop was published in a previous issue of the "Allahabad Farmer" Vol. XVI, No. 2. This year, altogether 10 varieties were under trial. Of these, however, two are strains of the same variety, namely C. 13. C. 13A is an Allahabad strain of this variety, while C 13 is a strain from Cawnpore.

Selection was made the previous year in this crop on I. P. 111 on the hairiness and non-hairiness of the glume, and on I. P. 4 on earliness; so that two strains of I.P. 111 and I.P. 4 were under experiment These are indicated as I. P. 111 (H) and I. P. 111 (NH), also I P.4 and I. P. 4 (E). The results of this experiment in respect of the weight of grain only were as follows:—I.P. 4 (E) = 106·90, I. P. 165 = 95·65, I. P.4 = 110 55, I. P. 111 (NH) = 98·75, I. P. 111 (H) = 74·50 I. P.52 = 117·50, I. P.54 = 111·40, Local = 95·15 C. 13 (C) = 136·65, C. 13 (A) = 128·75.

Besides these the department had several crops and several varieties of crops in small plots These were Sann-hemp, Dhanchia, Pillipesara, Sawan, Marwa, Kakun, Kodon, Maize, Soybean, Mung, Urd, Cowpea, Horse-gram, Til, Niger and Ground-nuts.

Besides these the department had several introductions of a number of varieties of wheat, linseed, peas, which were grown for multiplication, and the promising ones may be included in randomised block lay-outs this next season.

The hybridisation of C. 13 with I. P. 165 reported last year has produced results, and seeds which were the result of this cross were grown this year for multiplication. This experi- ment was, as reported last year, to combine the rust resistance of I.P. 165 and the high yielding quality of C. 13.

Demonstration.

The Farm.—The agricultural year under report (June 1942—May 1943) was a period of rough sailing. Unusual difficulties were experienced. The effects of the weather, the labour complications due mainly to the shortage of food and clothing all around, the difficulties in the availability of seeds and miscellaneous supplies, the irrigation, and irrigated land problems and so forth—all acted and reacted upon the year's business in one way or another. It was a period of hard test for the management. However, the results of farming borne out at the close of the year were not so bad as they were apprehended to be.

Weather.—The total rainfall in the year was below the normal (for Allahabad) by 1 6″ only, as against below 8″ last year. The monsoon rains started from the 24th of June. The *kharif* sowing went ahead well. After the seeds had germinated and the plants had grown a few inches, there came a break from July 7 to 17. Rains in July and August were not, however, excessive, but the Jumna floods, due to very heavy rains elsewhere, submerged about 40 acres of growing fodder from the farm. Thus the loss of about

16,000 maunds of green fodder brought about almost a fodder famine on the farm after the winter.

The heaviest rain (4·6") of the season came on the 4th of September and the monsoon was over by the 19th October, and November and the first 3 weeks of December were entirely rainless. Thus there was a long spell of dry weather for the *rabi* crops. The winter rains also were deficient, so slight and so for spaced as not to be of great value. However, the heavy fogs this winter helped the growing rabi crops quite a bit. There was a light hail storm also on the 6th of January, 1943. Later, storms and rains (about 0·7") came by the middle of April. They interrupted the rabi harvesting and threshing operations, caused some loss on the threshing floor and also difficulties in storage.

Seeds.—The farm grows and stocks all the *kharif* and *rabi* seeds needed by it but most of the vegetable seeds have yet to be bought from outside. Usually there has been no difficulty in obtaining our vegetable seed supplies, but unexpected developments took place during the year. No early potato seeds could be obtained from Patna. The August disturbances on railways introduced a great fear and uncertainty in the minds of seed potato dealers. Enterprising contractors from other provinces took the opportunity and carried away all the stock which they could lay their hands on by motor trucks for purposes mostly other than seed A large number of growers, thronging there to buy seed potatoes, had to go back disappointed.

The situation made us go in a hurry to Haldwani and Naini Tal for hill potatoes. Fortunately we got them. But part of the supply was poor in quality. An early purchase resulted in the rotting of more seed than usual. The price was also high. So this was the first year in the history of the Institute when all its potato area had to be planted with hill potatoes alone.

Many of the other vegetable seeds and the desired varieties were not available from the seed-firms. Whatever could be secured arrived late and was of unknown quality. Attractive names for vegetable varieties are not a sure guide to their quality. The produce at harvest time is the only sound test

for the farmer, when it is too late for him to do anything if the crop turns out to be poor Consequently, most of the vegetables other than potatoes were also poor on the farm.

Irrigation.—The local municipality has always been generous in the supply of sewage for irrigation on the farm during the monsoon months when nature also is bountiful in its downpours But the sewage supply diminishes with the approach of dry weather. This poor supply was felt keenly this year because of the unusually long spell of drought. Many crops had to be sown late, some were sown but did not receive water either for proper germination or for keeping up the young growth, some received only insufficient irrigation, and so forth.

One tube well was installed on that part of the farm which was acquired ten years ago and which had been unirrigated, poor and unlevel. This water is not available on the fertile area. The well came into operation from the middle of October 1942 Laying out of irrigation channels, bringing the fields a proper level for irrigation, and manuring were the main tasks. New irrigation channels give trouble until they are well consolidated. The cost of pumping water was also high in the beginning But this water is under our control. Many things have still to be done. As years go by, present investments will bring in more returns.

Labour.—The food problem is closely linked with the labour problem. One not having enough food in the day or not sure of getting food at the end of the day's work, cannot put his heart and soul in what he does. The shortage of food articles began to be manifest more and more as the year advanced. The shortage grew almost critical as the year was drawing to its close, and even now it is not very far from being that. Dearness allowance had to be given. After a short period it had to be revised and raised. Still men would run away at rumours of high wages. The general hardship has brought forth more women and children to work. But they cannot go far like men. So the farm has more women and children workers from the local villages than before. Their wages are also high but the work not efficient.

Farming cannot pay such high wages as short term enterprises can do, which have sprung up these days right and and left. The lure of high wages, although temporary, is hard to resist for a petty worker in these days. Still the labour cost went up, at least twice of the normal, in the year.

A farm workers' seminar was also started this year. The seminar was held about once a month. One of the staff would speak in Hindustani on a practical subject connected with field work and then discussions would follow. The skilled labourers took a lively interest in the subject and in the discussions. It was highly educative. A field worker works better when he understands why he has been asked to do a certain thing in a certain way at a certain time. The seminar did show improvement in the workers.

Field practices.—There is more concentration of hand labour at harvesting of crops than during any other field operation. For harvesting operation, India has not yet adopted the use of an implement or an improved tool except the small sickle. Harvesting of cereals or fodder consists of two parts: (a) cutting the stalk, and (b) gathering the cut stalks and binding them into sheaves for hauling. The rapidity in cutting the stalks is no advantage if it results in more shattering of grains or scattering of stalks, thereby increasing the labour cost in gathering and binding. Years before we used a bullock-drawn reaper, manufactured by the McCormick Deering Co for reaping wheat. It had to be stopped because of the disadvantage mentioned above.

A sled-harvester, the idea of which was caught from an American magazine, was fitted up by the Agricultural Engineering Department. It was used in harvesting fodder juar sown in lines. It was drawn by one pair of bullocks and the gathering and binding was done by additional labourers. The implement is being further improved in the light of studies made last year. It is expected to work better when used in the next *kharif* harvest.

A scythe was used for harvesting wheat. After a man was trained and got used to it, the cutting was quick enough but there was more shattering of grain and scattering of

stalks. However, further efforts are expected to improve the scythe operation also.

Efforts at better *rabi* seed bed preparation are continuing. Certain essential points have now been well recognised. (1) The rabi seed bed should be shallow; deep seed bed is costly, unnecessary, and the seed has to be sown deep. (2) Repeated cultivation should be timed to the appearance of new growth of weeds or a casual shower of rain This results in effective control of weeds and moisture. (3) The amount of work done per team per day should be large so that the cost of operation per acre is low and the rotation of operations takes place at short intervals. With the above objects in view, some old and some new implements were put to use. Acme Harrow did a good job in the alluvial part of the farm, which had no or very little weed growth on it. It did the full job of seed bed pre paration. No other implement was needed. In other places blade cultivators were used, which were designed by the Agricultural Engineering Department. Its function is to shave off weeds from underneath and make the soil friable without inversion. It takes about two feet in width. The U.P., plough with knife-blade attachments was used at places where either soil or weed growth offered more resistance.

Use of implements has been on a higher level. No additional bullocks were purchased in spite of increased cultivation due to the provision of irrigation on a much larger area than before. Bullocks have been not only very costly--at least twice the normal price—but also not easily available. Implement increases the work output of both the bullock and the driver.

A Siberian collective farmer, Andrei Abanov, is successfully using deer for ploughing. He has ploughed over six acres per day with specially trained deer.—F.O.C.

REPORT OF THE DEPARTMENT OF ANIMAL HUSBANDRY AND DAIRYING, 1942-43

By

T. W. MILLEN

This report covers the financial year of the Institute from April 1, 1942, through March 31, 1943. It records some of the activities and accomplishments of the department following the annual report of the department in the Allahabad Farmer one year ago.

Personnel

Mr. J. N. Warner	...	Department Head.
Dr. T. W. Millen	...	Veterinarian and Instructor.
Mr. N. R. Joshi	...	Instructor.
Mr. M.A. Samuel	...	Assistant Instructor.

Mr. N.R. Joshi was granted leave for one year to serve as Assistant Statistician to the Imperial Council of Agricultural Research. This leave began in March. Dr. S. S. Prabhu and Mr. S. B. Singh were appointed to temporary posts in the department during his absence. Mr. T. R. Nikam of the Indian Dairy Diploma class of 1940 became Supervisor of the Creamery on May 21st, 1942.

Milk and Milk Products [J. N. W]

The sales of milk and milk products during the year are given in Table I. Sales by months are indicated, as they were last year, to show the monthly variation for each item. The totals for the previous year are included for comparison.

TABLE I

Sales of Milk and Milk Products from April 1942 to March, 1943.

(Figures in pounds and ounces.)

	Milk	Butter	Dahi	Cream Chees	Creem	Ghee	Ice Creem	Chedd or Cheese	Daily average for milk
April ..	20226·8	1704·13	2674·0	41·4	40·4	3·0	551·8	113·13	674·3
May ..	14651·0	1305·8	1080·8	34·0	12·2	0 12	1298·8	65·12	472·10
June ..	13526·0	1589·6	846·8	47·8	7·10	..	1423·0	193·8	450·14
July ..	18650·0	1569·14	1161·0	59·0	16·3	..	1184·8	279·14	601·10
August ..	16727·8	1294·4	1550·8	25·4	12·6	..	900·8	68·0	539·9
September ..	14682·0	1482·6	1401·0	35·4	23·6	..	1557·8	209·7	489·6
October ..	16090·8	2299·13	1357·8	62·0	18·6	..	2458·0	53·10	519·1
November ..	16539·8	1692·6	1312·8	67·12	30·6	..	2244·8	138·6	551·5
December ..	1587·98	3379·2	955·8	138·10	30·2	..	884·0	222·1	512·4
January ..	17275·8	2841·6	931·0	201·4	29·4	..	741·0	203·0	557·4
February ..	19789·0	2790·6	1004·0	163·0	40·2	..	312·8	123·7	706·12
March ..	22110·8	2922·4	1900·0	114·4	23·4	..	1855·8	324·15	712·8
Total ..	206147·8	24871·8	16174·0	989·2	283·7	3·12	15411·0	1995·13	564·13
Previous year Total ..	280471·0	21072·3	13967·8	742·1	308·1	86·14	1740·8	180·8	768·6

Milk sales were highest in March and lowest in June. The difference in the daily averages of the two months was 261 pounds 10 ounces, or approximately 58% of the June sales. As is normally expected, from the figures given in Table II, the lowest sales occurred in May and June. The smaller total sales of milk this year, as compared with last, resulted principally from reduced receipts of whole milk. Conversion of a greater quantity of the whole milk received into the various milk products other than butter, in spite of reduced receipts,

was accomplished by separating only 33,817 pounds of such milk for butter making as compared with 92,080 pounds the year before. Cream purchases for butter making increased proportionately to make possible the sale of the amount of butter indicated

TABLE II.

Average Daily Sales by months of Bulk and Bottled Milk for Six Years, April, 1937 to March, 1943.

April ..	541	August ..	617	December ..	581
May ..	418	September ..	617	January ..	577
June ..	343	October ..	594	February ..	636
July .	505	November ..	650	March ..	648

Butter sales varied from 1294 pounds, 4 ounces in August to 3,379 pounds, 2 ounces in December. The low sales for the months of July, August and September were a result of our inability to obtain cream. Apart from the extremely great demands generally for milk and its products, including cream for butter making, there were other factors peculiar to that year which interfered. Two of these were difficulties of transport by rail and the flooding of the Jumna and Ganges rivers. Large quantities of cream must be taken across one of these two rivers by boat to reach a railway. This is almost impossible when the rivers rise as they did last year in late August and early September. The Jumna river, for example, at the Institute, was about 38 feet above its winter level, the highest in eight years. Other influences were discussed last year.

Dahi sales varied from 846 pounds, 8 ounces in June to 2,674 pound in April, a difference equal to about 216 per cent of minimum. This is very much the same as occurred last year. When the weather becomes hot *dahi* sales increase repidly so long as the customers remain in the market area. When they leave for their holiday the sales drop.

This year again very small quantities of cream cheese and cream were sold. There was a small increase in the sale of the former over last year, whereas cream sales were smaller. The sale of ghee was insignificant.

Ice cream sales made a tremendous leap upward this year, from only 1,740 pounds, 8 ounces to 15,411 pounds. Sales varied from 312 pounds, 8 ounces in February, which is a short month in the cold season when ice-cream consumption can be expected to go down, to 2,438 pounds in October, a difference equal to about 687 per cent of the minimum. August sales again, compared to July and September, reflect the general tone of business during that month.

Although vanilla flavour continues to be the most popular, considerable quantities of mango ice cream were sold. The squash used for flavouring, made by the Horticulture Department, was improved somewhat during the year for that purpose Both orange and lemon squash are being developed for use in ice cream but are not yet ready to be used *Gur*-nut ice cream has not become popular.

As was anticipated in the last report, cheddar cheese sales were much larger this year. Sales varied from 53 pounds, 10 ounces in October to 324 pounds, 15 ounces in March. Since no attempt was made at any time to meet the demand for this cheese, the sales show only the amount it was possible to make from milk not used for other purposes

Milking Stock

The strength of the Institute milking herd during the financial year of 1942-1943, *ending on March* 31*st*, 1943, *was as follows* :—

TABLE III.

Breed.	Number on 1-4-42.	Transferred from female young stock.	Purchased during the year.	Sold.	Died.	Number on 31-3-43	Remarks.
Red Sindhi ..	30	8	..	..	..	38	
Jersey-Sindhi ..	24	..	..	6	.	18	
Brown Swiss-Sindhi / Brown Swiss-Hariana	8	..	..	1	.	7	
¼ Holstein-Sindhi..	6	..	..	1	..	5	
¼ Jersey-Sindhi ..	16	11	..	1	..	26	
¼ Brown Swiss-Sindhi / ¼ B. S Hariana	18	5	..	4	..	19	
⅛ Jersey-Sindhi ..	2	1	..	..	..	3	
⅛ Holstein-Sindhi	1	4	..	..	..	5	
⅛ Brown Swiss-Sindhi ..	1	1	..	..	..	2	
⅛ Holstein-Sindhi	1	..	..	1	..	..	
⅜ Holstein-Sindhi	1	..	..	..	..	1	
Misc. Cows ..	17	4	..	4	..	17	
Pure Jersey ..	..	..	3	..	..	3	
Murrah Buffaloes	30	9	..	1	..	38	
Total ..	155	43	3	19	..	182	

A careful comparison of the tables in last year's report with those given this year will show a few discrepancies. Certain transfers from female young stock to milch stock had been incorrectly recorded. We believe that all records in the present tables are the correct ones.

Last year we lost 7 milking cows and one buffalo by death. This year not a single death occurred in our milking stock.

It will be noted that we have 3 pure-bred Jersey cows listed this year. These cows and a pure bred Jersey bull were presented to us by the Maharaja of Morvi and entered our herd in December, 1942.

During the year under report 4,14,171·8 lbs. of milk were produced. A breed by breed detailed record is given in Table V.

It will be noted in Table VI that we are raising a larger per cent of our female young stock. During the previous year 7 out of 15 buffalo calves died This year only 3 out of 15 died. Similarly in the Red Sindhi and cross bred calves we lost only 5 out of 53 born this year whereas last year 17 out of 62 perished.

In Table VII the outstanding accomplishment is the reduction of the age at first calving of the Murrah buffalo. The average age being 2·74 years as compared with 3·5 in the previous year. This saving of a year in the producing of a milking buffalo is the result of keeping the calf healthy and rapidly growing with no setbacks due to malnutrition or disease.

The Red Sindhi heifers had their first calf at an average age of 2·66 years which is significantly less than the 3·04 years reported for those a year ago.

TABLE IV

The following statement shows the performance of those animals which completed their lactations during the year 1942-1943

	No of lactations completed during the year 1942-1943	Average yield lbs.	Average days in milk	Average days dry preceding the lactation	Milking average per day during milking period	Over-all daily average	Remarks.
Red Sindhi ..	20	2585·0	286·7	104·4	9·0	6·6	
Jersey-Sindi ..	16	4690·0	340·5	63·3	13·8	10·0	
Brown Swiss-Sindhi } -Hariana }	2	6189·6	396·0	58·5	15 6	13·6	
¼ Holstein-Sindhi ..	4	3615·2	327·8	112·2	11·0	8 2	
¼ Brown Swiss-Sindhi	8	3286·0	317·8	66·3*	10·4	8·2*	2 Animals 1st lact. completed during the year. Included in over-all yield, but days dry not included.
¼ Jersey-Sindhi ..	8	3492·0	321·3	119·3*	10·6	8·5*	Two animals included in over-all daily average but the dry days preceding lact. not inclued being 1st lact.
Misc. Cows-Jerseys ..	8	2621·8	331·3	56·7	7·9	6·9	
⅛ Brown Swiss-Sindhi*	1	151·5	106·0	..	1 5	..	1st lact. completed during the year.
⅛ Brown Swiss-Sindhi*	1	1664·8	250·0	..	4·7		1st lact. completed during the year.
Murrah Buffaloes ..	15	2543·0	282·9	168·0 7 Excluded 1st lact completed.	9·0 Included 7 animals.	6·4*	* In over-all daily average only 8 animals included.

TABLE V.

	April	May	June	July	August	Sept.	October	Nov.	Dec.	Jan.	Feb.	March	
Red Sindhi ..	4593·1	3070·8	3130·5	3666·1	5600·1	5969·3	7344·3	6582·4	6322·8	7275·6	6778·7	6684·2	Total 67017.9
Cows in milk .	19·	19	17	17	16	23	26	27	29	30	31	30	Monthly average No. of cows. 35·41
„ Dry ..	12.	12	14	17	18	14	11	10	8	7	7	8	Over-all daily average. 5·16
Over-all daily average	5·0	3·3	3·4	3·17	5·3	5·37	6·4	5·93	5·37	6·34	6·4	5·67	
Jersey-Sindhi ..	7653·3	6789·0	6735·6	6481·3	5688·8	5272 5	5144·4	4311·7	4441·7	6140·0	6610·9	6779·5	Total .. 72051·4
Cows in milk ..	23	22	20	22	20	20	19	17	16	17	19	18	Monthly average No. of cows. 21·4
„ dry ..	1	1	3	1	3	1	2	4	4	3	..	..	Over-all daily average. 9·3
Over-all daily average	10·6	9·5	9·8	9·0	8·0	8·3	8·4	6 8	7·1	9·9	12·4	11·5	
Brown Swiss-Sindhi / Brown Swiss-Hariana / Brown S. Kahkrej ..	3126·7	2739·4	2496·5	2584·8	2056· 3	1997·7	2462·4	2075·9	1868 5	1853·4	1615	1689·5	Total .. 26566·8
Cows in milk ..	6	6	7	7	7	7	7	7	7	7	6	6	Monthly average No of cows. 7·3
,, dry ..	2	2	1	1	1	1	..	..	.	..	1	1	Over-all daily average.
Over-all daily average	14·9	12·6	10·4	10·4	8·3	8·3	11 3	9·9	8·6	8·5	8·2	7·8	10·0
¼ Holstein-Sindhi ..	2245·1	1644·2	1088·9	882·3	644·8	313·1	502·8	1139·1	1393·4	1465·4	1947·7	1766·2	Total .. 15033·0
Cows in milk ..	6	6	55	5	5	5	5	5	5	5	5	5	Monthly average No. of cows. 5·16
„ dry ..	..	..	..	..	..	..	..	..	..	..	..	..	Over-all daily average.
Over-all daily average	12·5	8·85	7·0	5·7	4·2	2·1	3·2	7·6	9·0	9·4	14·5	11·5	7·95

¼ Jersey-Sindhi ..	3684·5	3415·0	3478·0	4819·4	4090·6	4271·5	4787·4	4205·1	3774·1	4715·7	6121·3	7005	Total .. 54367·8
Cows in milk ..	12	11	13	14	13	18	18	18	17	20	25	25	Monthly average No. of cows. 19·5
„ dry ..	4	5	3	3	5	1	1	1	2	3	1	1	Over-all daily average.
Over-all daily average	7·67	6·9	7·24	9·14	7·4	7 5	8·2	7·3	6·4	6·6	8·4	8·7	7·62
¼ Brown Swiss-Sindhi	4835·8	37751	3845·8	4248·1	4043·6	4154·7	4316·5	3555·6	3137·9	3764·6	4096·5	3548·3	Total .. 47322·5
„ Hariana ..	..	..	..	..	..	..	..	..	..	..	..	..	Monthly average No. of cows.
Cows in milk ..	13	13	13	13	13	15	15	15	13	15	14	13	Over-all daily average. 17·8
„ dry ..	5	3	4	4	5	3	3	3	4	4	5	6	
Over-all daily average	9·0	7·6	7·6	8·0	7·3	7·7	7·7	7·0	6 0	6·4	7·7	6·0	7·3
⅛ Jersey-Sindhi .	915·8	760	709·2	832 6	580·0	414·2	337·5	271·3	225·6	241·7	186·5	179·3	Total .. 5653·8
Cows in Milk ..	2	2	2	3	3	3	2	2	2	2	2	2	Monthly average No. of cows. 2·75
„ Dry ..	..	..	..	..	..	..	1	1	1	1	1	1	Over-all daily average,
Over-all daily average	15·0	12·2	11·4	8·9	6·1	4·6	3·6	3·0	3·0	2·6	2·1	1·9	6·2
⅛ Holstein-Sindhi ..	457·0	451·1	405·3	403·0	358·0	533·4	513·6	435·7	529·6	849·6	626·9	440·3	Total .. 6003·5
Cows in Milk ..	2	2	2	2	3	3	3	3	4	5	4	4	Monthly average No. of cows. 3·2
„ Dry ..	..	..	..	..	..	..	..	..	..	..	1	1	
Over-all daily average	7·6	7·3	6·7	6·7	3·8	5·9	5·6	4·8	5·7	5·4	4·5	2·8	Over-all daily average. 5·6
⅛ Brown Swiss-Sindhi	62·0	54·1	36·8	39·7	..	..	-	..	..	122·0	807·8	820·3	Total .. 1942·7
Cows in Milk ..	1	1	1	1	..	..	..	..	..	1	2	2	Monthly average No. of cows. ·75
„ Dry ..	..	..	..	..	1	1	1	1	1	..	..	..	Over-all daily average. 3·15
Over-all daily average	2·0	1·74	1·2	1·3	..	..	..	..	..	4	14·4	13·2	

TABLE V.—*(Contd.)*

	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
½ Holstein-Sindhi ..	238·0	178·8	154·7	149·2	81·2	..							
Cows in Milk ..	1	1	1	1	1	Sold							
„ Dry ..	..	..	..	..	.	..							
Over-all daily average	7·93	5·8	5·2	4·8	Sold								
⅜ Holstein-Sindhi ..	493·4	428·0	395·8	333·4	326·3	256·8	241·5	217·5	196·1	243·5	206·5	163·9	Total . 3502·7
Cows in Milk ..	1	1	1	1	1	1	1	1	1	1	1	1	Monthly average No. of cows. 1
„ Dry ..	..	..	..	..	..	..	..	..	..	..	..	..	Over-all daily average. 9·5
Over-all daily average	16·4	13·8	13·2	10·8	10·5	8·6	7·8	7·0	6·3	7·9	7·4	5·3	
Misc. Cows ..	4353·2	4219·5	3276·0	3392·2	3258·3	1882·1	2933·9	1935·2	1942·4	3379·1	4163·9	3639·8	Total .. 38375·6
Cows in Milk ..	15	16	15	15	16	14	12	13	11	12	15	15	Monthly average No. of cows. 16·0
„ Dry ..	2	1	1	1	1	2	3	3	4	2	2	2	
Over-all daily average	8·4	8·0	6·8	6·9	6·1	3·92	6·3	4·0	4·2	8·0	8·8	7·0	Over-all daily average. 6·53
Murrah Buffalo ..	4280·3	4502·2	4251·9	5332·6	6036·2	6560·5	7897·7	8971·1	8895·1	8155·1	5872·6	5312·5	Total .. 76067·8
Buffalo in Milk ..	19	23	19	19	23	25	29	31	31	30	28	13	Monthly average No. of cows. 37·5
„ Dry ..	13	13	18	18	15	13	10	8	8	9	11	15	
Over-all daily average	4·5	4·0	3·8	4·7	5·1	5·8	6·5	7·7	7·3	6·7	5·3	4·5	Over-all daily average. 5·5

Total Cows lbs. ..	32757·9	27525·0	25753·1	27835·1	26728·1	24765·3	28584·3	23729·5	23832·1	30277·3	33412·5	32933·8	Total Cow's Milk. 338104·0
Cows in Milk ..	101	100	97	101	98	109	108	108	105	116	125	122	Monthly average No. of cows. 132·0
„ Dry ..	26	24	26	27	34	23	22	23	24	22	20	22	Over-all daily average. 7·0
Over-all daily average	8·6	7·1	7·0	7·0	6·6	6·2	7·0	6·0	6·0	7·1	8·2	7·4	
Murrah Buffaloes ..	4280·3	4502·2	4251·9	5332·6	6036·2	6560·5	7897·7	8971·1	8895·1	8155·1	5872·6	5312·5	Total Buffaloe Milk. 76067·8
Buffaloes in Milk ..	19	23	19	19	23	25	29	31	31	30	28	13	Monthly average No. of cows. 37·6
„ Dry ..	13	13	18	18	15	13	10	8	8	9	11	15	Over-all daily average. 5·5
Over-all daily average	4·5	4·1	3·9	4·6	5·1	5·8	6·5	7·6	7·4	6 7	5·3	4·8	
Jersey	..	..	..	..	..	..	..	..	..	226·7	259 8	217·5	Total .. 695·0
Cows in Milk ..	..	..	..	..	..	..	..	..	..	1	1	1	
„ Dry ..	..	..	..	..	..	..	..	..	..	2	2	2	Monthly average No. of cows. 3·0
Over-all daily average	..	..	..	..	..	..	..	..	..	2·4	3·0	2·3	Over-all daily average. 2·56

Total milk production

Cows:—	338104·0
Buffaloes:—	76067·8
	414171·8

Female Young Stock

The following statement gives the number of Female young stock in the herd during the year ending March 31st, 1943.

TABLE VI

Breed		Number on 1-4-42	Born during the year	Transfer to milch stock	Sold	Died	Number on 31-3-43
Red Sindhi ...	...	27	13	8	...	2	30
Jersey-Sindhi ...	...	...	...	...	...	...	...
Brown Swiss-Sindhi Brown Swiss-Hr.	}	...	...	...	...	...	...
½ Holstein-Sindhi	...	2	...	...	...	...	2
½ Jersey-Sindhi	...	36	10	11	...	...	35
¼ Brown Swiss-Sindhi ¼ ,, Hr.	}	8	...	5	...	...	3
⅛ Jersey-Sindhi	...	7	10	1	...	2	14
⅛ Holstein-Sindhi	...	13	3	4	...	...	12
⅛ Brown Swiss-Sindhi	...	13	9	1	...	1	20
3/16 Holstein-Sindhi	...	1	...	...	...	...	1
1/16 Jersey-Sindhi	...	1	1	...	...	...	2
1/16 Holstein-Sindhi	...	...	2	...	...	...	2
Misc. Cows ...	...	16	5	4	...	...	17
Murrah Buffaloes	...	26	15	9	...	3	29
Total	...	150	68	43	...	8	167

TABLE VII.

The average age, weight and height at withers at first calving of 43 *Heifers transferred to milch stock during the year* 1942-43 (*April* 1942—*March* 1943).

Breed.	Average age.	Average weight in lbs.	Average height at withers.
Red Sindhi	2·66 years	564·75 lbs.	44·9″
¼ Jersey-Sindhi	2·41 years	574 „	43·6″
¼ Brown Swiss-Sindhi ..	2·6 years	589 „	44·37″
⅛ Jersey-Sindhi	2·42 years	552 „	43·2″
⅛ Brown Swiss-Sindhi ..	2·73 years	565 „	45·5″
⅛ Holstein-Sindhi	2·42 years	589 „	45·1″
Misc. Cows	2·53 years	598 „	47·0″
Murrah Buffalo	2·74 years	1048 „	51·7″

Poultry

We have increased the size of our White Leghorn and Rhode Island Red flocks. A good number of hatching eggs from each breed were sold during the year. We also sold a number of mature breeding fowls.

This year we have added ducks to our poultry enterprise. Local ducks of various colours were secured; and from these selections were made for size, skin colour, white egg colour, egg size and production.

In the first generation, several individuals were produced which were heavier than any of the parent stock. Two colour patterns have been selected for further development.

Sheep

The sheep flock has been maintained at about the same size as in recent years. A number of rams were sold and some females were culled from the flock. The quality of the flock has been improved by the use of a fine Hissardale ram. This past year we slaughtered and sold as meat all sheep culled from the flock. In this way we secured more than double the amount offered to us by the butchers and at the same time had both material for class demontrations, and a source of fine quality meat for our staff

Goats

Our Jumnapari herd was depleted by a disease which started during the last monsoon. We believe the cause was a fungus which they acquired through contaminated drinking water. Mange then attacked the goats while they were in a weakened condition and for a while it looked as though the entire herd would be wiped out. Five of the females from the original Etah herd and eleven young females completely recovered. We also have three of the original bucks and a number of young bucks. We did not have a single live kid born for one year, but most of the females will kid during the cold season this year. We will keep all female kids to build up our numbers and most of the male kids will be raised under the United Provinces Stud Buck Scheme and distributed for crossing with the *desi* goats in the province.

We held our first Goat Show in connection with our annual Farmer's Fair in March. Three classes were shown; large size, dwarf size and cross-bred progeny from our bucks. There has been a steady increase in the number of goats brought for crossing with our bucks. A number of fine progeny resembling the Jumnapari are now found in Allahabad and nearby villages.

Swine

Two Middle White Yorkshire boars were placed under our supervision by the Rural Development Association. These were made available for crossing with village sows. It was thought that the villager should contribute to the cost of

maintaining the boar. Several plans were offered such as a charge of annas 4 per sow, a quantity of grain or a pigling from 7 to 10 days old from each litter. All chose the latter plan. So by the end of the year we had ten piglings from this source We also bought up seven more pigs from the first litter farrowed. At eight months the runt in the litter, a barrow, had attained a weight of 130 lbs The cross bred progeny of one village sow were permitted to breed at will among themselves and produced pigs at 8 months of age which means that both the males and females were sexually mature at 4 months of age

All pigs purchased were one month old or younger. The lice were removed from them as soon as they arrived at our farm and until now our swine herd has been kept free from parasites and infectious diseases. At the end of the year we had 48 head in our herd

Our pigs are weaned at two months of age and the sows are bred again for a second litter.

Artificial Insemination

We have had 8 calves born recently to cows that were inseminated by three different bulls during the past year. The accompanying chart gives information on these individually. It so happens that the sexes were evenly divided. The average birth weight for pure bred Sindhi calves here at the Institute is 42 lbs The two pure bred Sindhi calves were both heifers and weighed 45 and 50 pounds respectively. The 70 pound and 62 pound cross-bred males are being raised for draft oxen.

We have had some trouble persuading the public to accept this method of impregnating cows. We have been unable to allow them to have their cows served directly by our herd bulls due to the prevalence of disease in the city and surrounding villages. All our cattle are tested at least once annually for tuberculosis, brucellosis and Johlne's disease. All reactors are segregated from the rest of the herd and are bred only by artificial insemination. In this way we have been able to keep our bulls free from disease,

whereas a few years ago we had to replace several bulls that had contracted one or more of these three diseases from infected cows in our own herd or from the outside and were sources of further contamination for our healthy animals.

We have offered the choice of three bulls to the public if they are willing to have their cows impregnated artificially. These are a pure bred Sindhi (out of our best cow, Sindh Queen and one of our proved Sindhi Sires) ; a pure bred Jersey bull; and a cross-bred Jersey-Sindhi bull.

Seven outside cows have now been thus inseminated with the first calf due in August 1943. Some of these cows had been taken to two or three bulls before being submitted to our revolutionary methods. So far none have been brought back to us for a second service.

This past year we trained one of our buffalo bulls for use in artificial insemination of the buffalo. We used his sperm for impregnating a number of our own animals and then offered this service to those in the surrounding area who were finding it difficult to find a good buffalo bull nearby. To date two outside animals have been thus impregnated. What we believe to be the first buffalo calf produced by artificial insemination in the world was born in our herd, August 21st, 1943. It was a male weighing 80 pounds and stood 28·3" at the withers. The buffalo cow No 271 had been impregnated artificially on 7th October, 1942. A second buffalo calf, this time a heifer, was born on 30th August, 1943 to buffalo No. 241 which had been impregnated artificially with sperm from the same buffalo bull on 28th October, 1942 This heifer calf weighed 66 pounds and stood 26" high at the withers.

This buffalo cow No 241 showed false heat on 22nd November, 1942 and was inseminated again, but the calf resulted from the first insemination. These two gestation periods were 318 days in the case of the male calf and 310 days for the female.

TABLE VIII.

Calves resulting from Artificial Insemination, 1943.

Serial No.	Cows No.	Breed.	Bull used.		Date born.	Sex.	Weight & height at withers at birth.	
			No.	Breed.			Wt. in lbs.	Height.
1	345	BS-K.	579	Red Sindhi.	4-6-43	Male	70 lbs.	26·3"
2	600	¼ G-¾ S.	579	Red Sindhi.	24-5-43	Female	35 ,,	24·6"
3	435	J-S	579	Red Sindhi.	30-6-43	Female	40 ,,	25·0"
4	401	Red Sindhi.	617	Red Sindhi.	23-7-43	Female	45 ,,	25·4"
5	520	½ BS-S.	617	Red Sindhi.	23-7-43	Male	62 ,,	25·5"
6	474	J-S.	617	Red Sindhi.	7-7-43	Male	53 ,,	26·1"
7	458	J-S.	579	Red Sindhi.	31-7-43	Male	42 ,,	25·7"
8	503	Red Sindhi.	83	Jersey Sindhi.	30-7-43	Female	50 ,,	25·3"

Bees

In March we were hosts to the All India Bee Keepers' Association which held its Annual Exhibition and Meeting in connection with our Farmers' Fair.

We won the following prizes on exhibits :—

Apis dorsata honey		...	...	1st prize.
Modern hive	...	...	...	1st prize.
Honey extractor	...	...	...	2nd prize.
1 lb. cake of wax	...	...	...	2nd prize.

Demonstrations were given of the hiving of plains Apis indica, Apis flora and Apis drosata bees during the three day period. Two of our greatest difficulties with apiculture are

(*Continued on page* 216)

REPORT OF THE ECONOMICS DEPARTMENT, 1942-43

By

Sam Higginbottom

The work of the department has been carried on by the Principal and Mr. H. S. Azariah. Economics or Farm Management is taught to all seven Institute classes. The Principal is doing less and less of the teaching and more and more is being done by Mr. Azariah.

So much of improved new material is being published in the field of Agricultural, Rural and Post-War Economics that it is highly desirable that many more modern books be purchased for the library for the use of the students of economics. Mr. Vaugh, the agricultural engineer, in his analysis of the factors that make for an increased standard of living, is greatly supporting the work of the economics department. One of the great needs of India to-day is not less economic theory, but it is the carrying of the economic theory through to its logical conclusion by applying it to actual conditions in India. I refer especially to the modern theories of wages, to the modern emphasis on the importance of production and the necessity for profits. There can be no increase in the standard of living, if there are no profits in agriculture or industry. Poverty is in almost direct proportion to the amount of hand-labour used in both agriculture and industry. From among the terrible things the war has brought to the world, it is well to remember that a few good things are emerging One is the breaking down of the idea of national isolationism and self-sufficiency. Another good thing is the increased industrialisation of India which can only persist in a satisfactory manner if labour is released from other occupations into industry. At present the Indian countryside suffers from the fact that practically all are growing the same things and there is therefore little or no local market. The industrialization of India would create a much larger demand for farm produce and would therefore raise the price of agricultural wages, all of which are highly desirable and indeed necessary if the standard of living is to be raised in the Indian village.

REPORT OF THE HOME-MAKING DEPARTMENT, 1942-43

By

Ethel Cody Higginbottom

It is a pleasure to write a report about the Home-Making Department because we, the staff and the girls, are so happy in it. We appreciate what we have, although often reminded of what would make us more efficient. We grow slowly but surely and now can call ourselves an Intermediate College in Home-Making. We also hope soon to add our 3rd year—that is to train teachers to teach Home-Making. There are 21 girls; more than we have had before. Many girls wanted to take our old English Teachers Course but that did not allow sufficient time for the Home-Making subjects. Besides, our girls were not called to teach 9th and 10th standards where they were most needed with their training as teachers of domestic science. Our first year as a college with many enquiries and late applications reveals how much our course is attracting the attention of people and what can be done.

Lady Hallett, wife of our Governor, very graciously gave us a whole afternoon on August 13th. At that time the girls demonstrated what they are learning in cooking, sewing, handicrafts, nature study, laundry and poultry. We also showed what our girls are doing in gardening. Then Lady Hallett told a small group of visitors that she thought very highly of our course and hoped some of it may be taught in every girls' school in the province. "To make a happy, healthy, and beautiful home should be the ambition of every woman", she said. Then the girls sang one of their songs:

We plough a field and sew a seam and
milk a cow just right.
we conquer soils and chemistry,
We study with all our might.
For while we work at the Institute
We are working for India, too,
That all her sons and daughters
May live full lives and true.

Chorus : Agricultural Institute
Greater be thy name !
The land is great and we are small
Yet may this be our aim,
That as we have been served by you,
We may serve our India, too.

We hope that next year we can have more of the sisters, wives and daughters of our old boys.

Let us do our work as well,
Both the unseen and the seen;
Make the house where gods may dwell,
Beautiful, entire and clean.

—*Longfellow.*

(*Continued from page* 213)

the lack of sufficient nectariferous flora and a suitable bee. We have secured the seed of several kinds of trees and plants which we hope will provide the necessary flora within a few years. We are studying the requirements and adaptability of the Apis indica bees which are found locally. The ones we have now appear to be mixed with hill bees which escaped from our apiary during the last two years They are showing some better qualities than those caught previously but we are still unable to get a virgin to return to the hive from her mating flight. They invariably abscond with the whole colony ; so our only method of increase is still the capturing of wild colonies.

Research shows that if cows are fed and milked three times a day instead of twice, milk production will increase 10 per cent to 25 per cent.

UNITED PROVINCES DEPATMENT OF AGRICULTURAR

MONTHLY AGRICULTURAL REPORTS

MAY, 1943.

I—Season.—During the first and second weeks of the month under report light showers were received in many of the districts, mostly eastern, the rainfall being heavier in the second week than in the first. Also, whilst the third week was practically rainless, rainfall during the fourth week was liberal throughout the province. The total rainfall was in excess of the normal in 12 districts.

II—Agricultural Operations.—Agriculture operations are generally up-to-date. Harvesting of the rabi crops in all the districts is finished, but threshing is still in progress in some districts. Irrigation of sugarcane and zaid crops and. preparation of the land for kharif sowing are in progress Sowing of cotton and maize in irrigated areas in the Etawah district and of paddy and cotton in the Cawnpore district has commenced.

III—Standing Crops and IV—Prospects of the Harvest.—The condition of the standing crops and the prospects of the harvest are, on the whole, satisfactory.

V—Damage to Crops.—Damage by fire is reported from the Muzaffarnagar and Meerut districts.

VI—Agricultural Stock. The condition of agricultural stock is on the whole satisfactory, although cattle diseases have been reported from a number of districts. From Table 1, compiled from data supplied by the Director of Veterinary Services, United Provinces, it would appear that there has been, since the last month, a marked decrease both in the total number of seizures as well as deaths and a slight decrease in mortality. As regards Anthrax, the number of seizures is the same as in the preceding month, but there has been a decrease in the number of deaths, resulting in a marked decrease in mortality. In the case of Hæmorrhagic Septicæmia, there has been a decrease in the number of seizures

but an increase in the number of deaths, resulting in a marked increase in mortality. No cases of Blackquarter have been reported during the month There has been a marked decrease both in the number of seizures as well as death from Rinderpest and a slight decrease in mortality. As regards Foot and Mouth disease, there has been a marked decrese in the number of seizures and deaths, and mortality. There has been a very pronounced increase both in the number of seizures as well as deaths from "Other Diseases", but a marked decreased in mortality.

Table 1.—Number of seizures, deaths and mortality from cattle diseases in April and May, 1943

Diseases	Seizures		Death		Mortality.	
	April	May	April	May	April	May
Anthrax .	4	4	3	1	75	25
Hæmorrahagic Septicæmia ..	44	33	23	30	52	91
Blackquarter ..	3	..	3	.	100	..
Rinderpest ..	993	784	472	372	48	47
Foot and mouth	5,970	5,506	48	17	0·80	0·31
Other diseases .	6	113	3	25	50	22
Total .	7,020	6,440	552	445	8	7

N.B.—Mortality $= \frac{\text{No. of deaths}}{\text{No. of seizures}} \times 100$

VII—Pasturage and Fodder.—Sufficiency of pasturage and fodder is reported from all the districts except the Hamirpur, Ballia and Unao districts.

VIII—Trade and Prices.—In Table 2 are shown the retail prices of important agricultural commodities in rupees per maund at the end of the month under report and of the preceding month. It would appear from the table that there has been, since the last month, a marked increase in the prices of all the commodities, the increase being most pronounced in the case of rice, wheat and gram.

Table 2.—Retail prices in rupees per maund of Agricultural commodities for April and May, 1943.

Commodities	Retail prices	
	April	May
Rice	13·362	16·937
Wheat	10·253	13·287
Barley	7·145	8 874
Gram	7 601	9·786
Arhar Dal	11·423	12·909

IX.—Health and Labour in Rural Areas:—The condition of agricultural labour in rural areas has been satisfactory, although cases of small-pox, cholera and plague, have been reported from some districts.

JUNE, 1943

I—Season:—During the month under report, the first week was practically rainless except for some light showers in the east of the province, and in the Naini Tal and Almora districts. Rainfall during the second and third weeks was liberal throughout the province. During the fourth week, rainfall, although general, was lower than during the second and third weeks. The total rainfall was in excess of the normal in 10 districts.

II—Agricultural Operations:—Agricultural operations are generally up-to-date. Irrigation of sugar-cane and *zaid* crops and preparation of land for *kharif* crops are in progress. Sowing of *kharif* crops is proceeding in most of the districts, particularly in irrigated areas and where there is sufficiency of moisture in the soil.

III—Standing Crops and IV—Prospects of Harvest:—The condition of the standing crops and the prospects of the harvest are, on the whole, satisfactory, but much depends on future rain which is urgently needed.

V—Damage to Crops:—Damage by locusts is reported from the Garhwal districts.

VI—Agricultural Stock:—The condition of agricultural stock is, on the whole, satisfactory, although cattle diseases have been reported from a number of districts. From Table 1, compiled from data supplied by the Director of Veterinary Services, United Provinces, it would appear that there has been, since the last month, a marked decrease in the total number of seizures but an increase in the total number of deaths, resulting in a marked increase in mortality. As regards Anthrax, there has been a considerable increase in the number of seizures, deaths and mortality. In the case of Hæmorrhagic Septicæmia, there has been a marked increase both in the number of seizures as well as deaths, and a slight increase in mortality There have been 49 cases of seizures and 44 of deaths from blackquarter, resulting in in 90 per cent. mortality, as against no cases during the preceeding month. In regard to Rinderpest, there has been a marked increase in the number of seizures, a slight increase in the number of deaths and a slight decrease in mortality. In the case of Foot and Mouth disease, there has been a pronounced decrease in the number of seizures but only a slight decrease in the number of deaths, giving a marked increase in mortality. No cases of seizures of deaths from "Other Diseases" have been reported during the month.

Table 1.—*Number of seizures, deaths and mortality from cattle diseases in May and June, 1943.*

Diseases	Seizures		Deaths		Mortality	
	May	June	May	June	May	June
Anthrax ..	4	8	1	6	25	75
Hæmorrhagic Septicæmia ..	33	92	30	87	91	95
Blackquarter ..	..	49		44	.	90
Rinderpest ..	784	884	372	378	47	43
Foot and mouth ..	5,506	2,900	17	16	0·31	0·60
Other diseases ..	113	..	25	..	22	..
Total ..	6,440	3,933	445	531	7	14

N.B.—Mortality $= \frac{\text{No. of deaths}}{\text{No. of seizures}} \times 100$

VII—Pasturage and Fodder:—Pasturage and fodder are reported to be sufficient in all the districts except in the Hamirpur, Benares, Ballia, Garhwal and Unao districts where the rainfall has not been adequate so far.

VIII—Trade and Prices:—The retail prices of important agricultural commodities in rupees per maund at the end of the month under report and of the preceding month are presented in Table 2. It would appear from this table that there has been, since the last month, an increase in the prices of all the commodities, the increase being most pronounced in the case of rice.

Table 2.—Retail prices in rupees per maund of agricultural commodities for May and June, 1943

Commodities	Retail prices	
	May	June
Rice	16·937	18·691
Wheat	13·287	13·962
Barley	8·874	9·652
Gram	9 786	10·454
Arhar Dal	12·909	13·904

IX—Health and Labour in Rural Areas:—The condition of agricultural labour in rural areas has been generally satisfactory. Outbreaks of smallpox, cholera and plague have been reported from some districts.

Due to a shortage of imported wheat, Venezualands are now eating bread made partly from *banana* flour—and liking it.

REVIEW

THE PRESERVATION NUMBER

The 1942 *Annual Number of the Punjab Fruit Journal*)

Foreword by the Hon'ble Rao Bahadur Ch. Sir Chhotu Ram, Minister for Revenue, Punjab.

Edited by S. B. S. Lal Singh, Fruit Specialist, Punjab, Lyallpur
and
Dr. Girdhari Lal, Bio-Chemist, Fruit Products Laboratories, Lyallpur.

Available from The Punjab P. C. Fruit Development Board, Lyallpur.

"There is an extreme dearth of authentic literature dealing with fruit and vegetable preservation pertaining to Indian conditions, as books written by foreign authors do not fully answer our purpose. There was, consequently, a keen demand for the publication of suitable literature on the subject. And this demand has been still further intensified by the present war inasmuch, as importation of foreign products has almost completely stopped, there is need for local production, and in fact, a rare opportunity to develop this industry when it can have a normal chance of survival without being strangled by foreign competition."

Keeping the above in view, the Punjab Fruit Development Board, which has earned a reputation for bringing authoritative literature on gardening suitable to Indian conditions, has devoted the fifth Annual Number of the Punjab Fruit Journal exclusively to the Fruit and Vegetable Preservation Industry. We congratulate our contemporary in completing its first quinquennium and for establishing itself as a successful venture in horticultural journalism in the East.

This compendium will surely be of immense use to those who are interested in Fruit and Vegetable Preservation and will be welcomed alike by research scholars and commercial magnates.

It is a handy illustrated Annual comprising seventy (70) pages replete with facts essential for starting the Preservation Industry both as a war and post-war measure. Some of the most informative articles in this 'souvenir' are:

Future of Fruit Preservation Industry—War and the Preservation Industry—Facilities for Training in Fruit Preservation—Equipment for a Fruit Preservation Factory—Preparation of Citrus Fruit Squashes and Cordials—Preparation and Preservation of Unfermented Apple Juice—Preparation of Jam from pears and plums—Tomato Ketchup—Tomato Juice—Guava Cheese—Pickling of Vegetables—Drying of Vegetables—Vinegar Manufacture for Home Use—Control of 'Spoilage' in Canned Foods—Summary of the work done in Fruit and Vegetable Preservation at the Fruit Products Laboratories, Lyallpur—Directory of Firms Supplying Fruit Products and Fruits.

This Number is priced at Re. 1-8 including postage on pre-paid Money Order basis or V.P.P. basis; but to regular subscribers of the journal and the members of the Punjab Fruit Development Board, this Number along with other issues of the journal is supplied free. The Annual subscription of the journal is Rs. 3 on pre-paid Money Order basis and Rs. 3-8 per V.P.P. basis.

NOTE:—Popular abridged Urdu Edition of this Special Preservation Number, comprising 40 pages of the reading matter priced at Re. one including postage on pre-paid Money Order basis or V.P.P. basis, is also available for sale.

For further particulars please write to—

THE HONY. SECRETARY,
Punjab P. C. Fruit Development Board, Ltd.
Punjab Agricultural College, Lyallpur (India)